National Capital Consortium USUHS

Routine Immunizations

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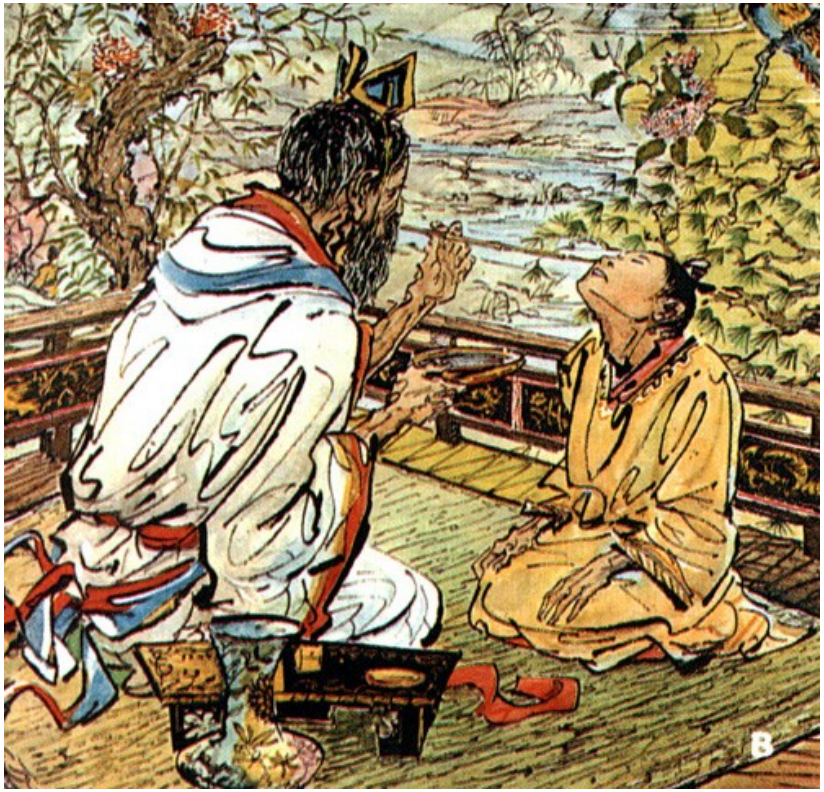
Objectives

- Understand the historical background and basic principles of immunization
- Describe immunobiologic components and their advantages and disadvantages
- Discuss indications and contraindications for commonly used immunizations
- Describe recent changes in vaccine recommendations
- List resources for immunization questions

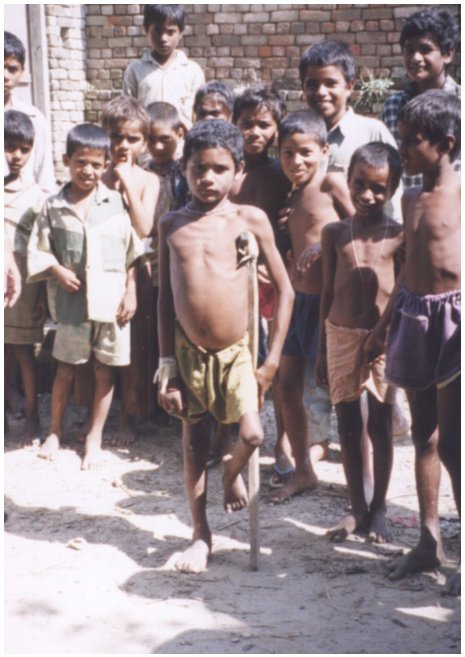
Variolation

- **“Artificial” infection of susceptible person with variola virus**
- **Practiced in China and probably India in the 9th century**
- **Infection by different routes**
- **Later practice inoculation of arm**



Jenner vaccinates James Phipps, 14 May 1796

Modern Immunization Milestones



1884 – Pasteur and attenuated rabies vaccine

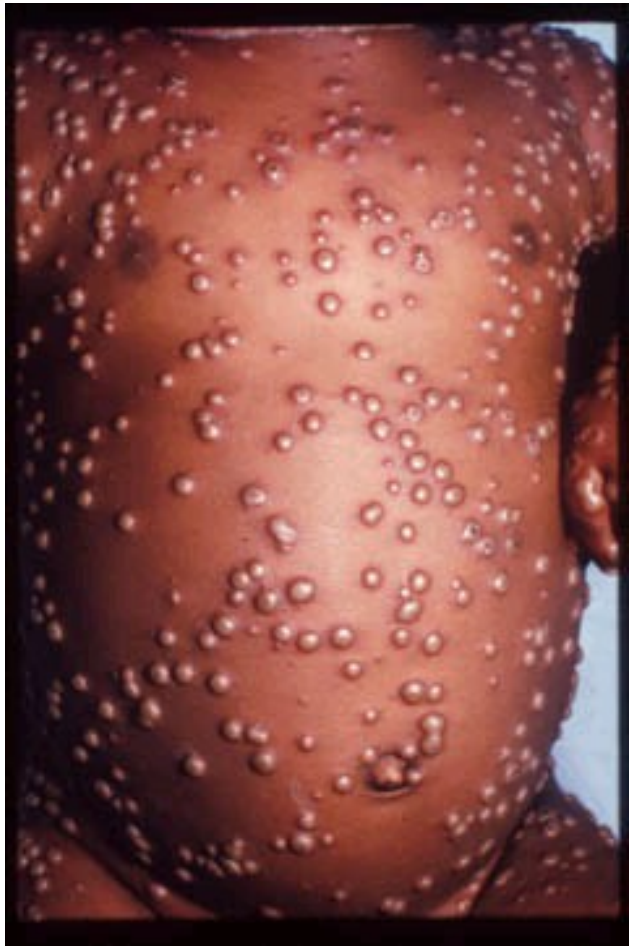
1955 – Inactivated polio vaccine licensed

1963 – Measles and trivalent oral polio vaccine licensed

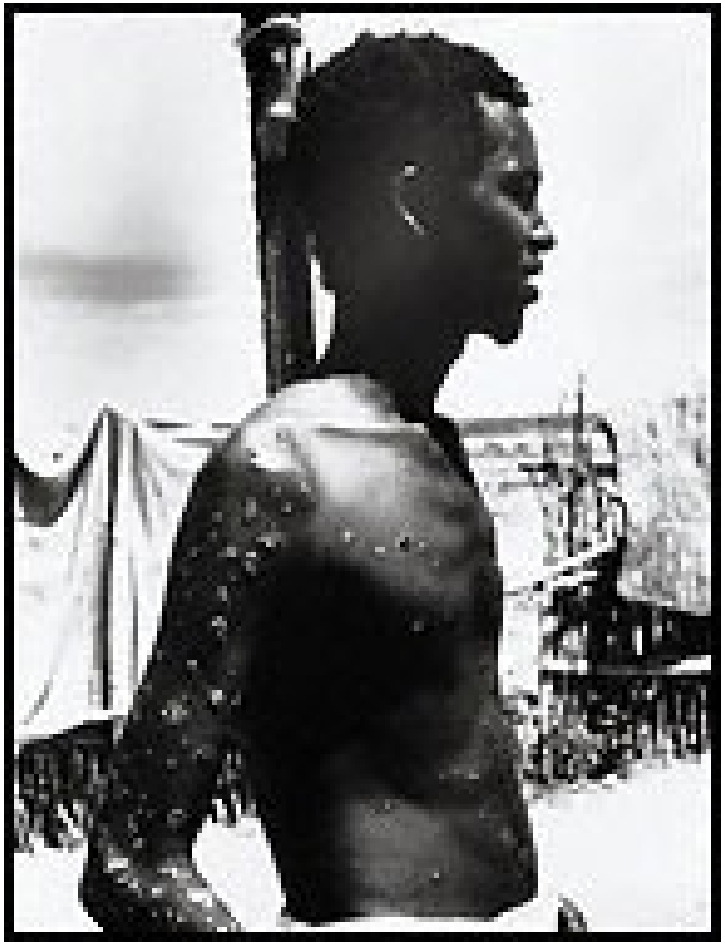
1977 – Last indigenous case of smallpox

1994 – Polio eradication certified in Americas

Vaccination Success:
Smallpox The first 'extinct'



Smallpox

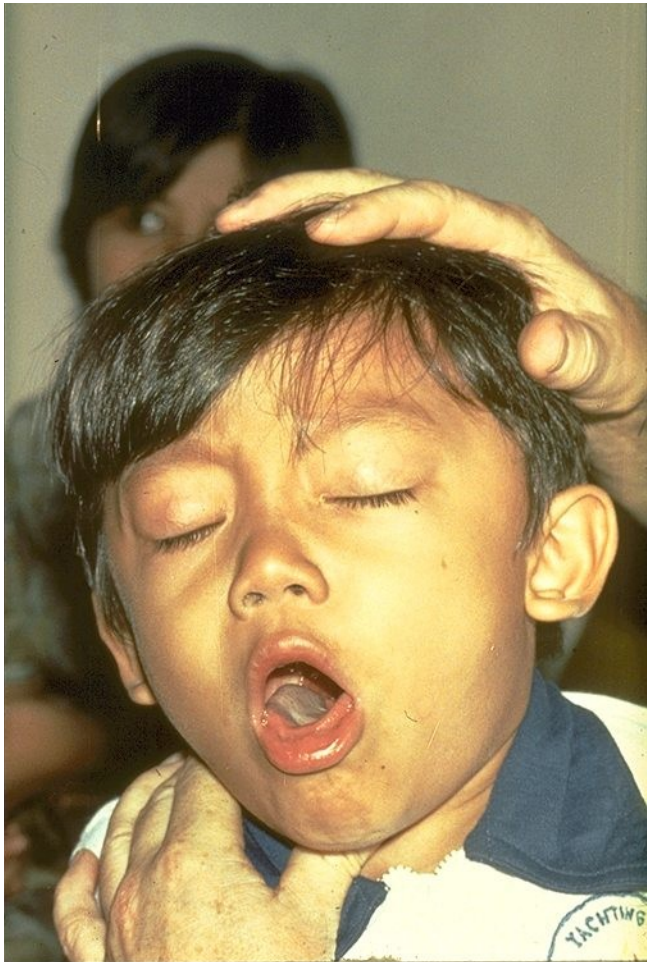


Last case-Somalia (1977)

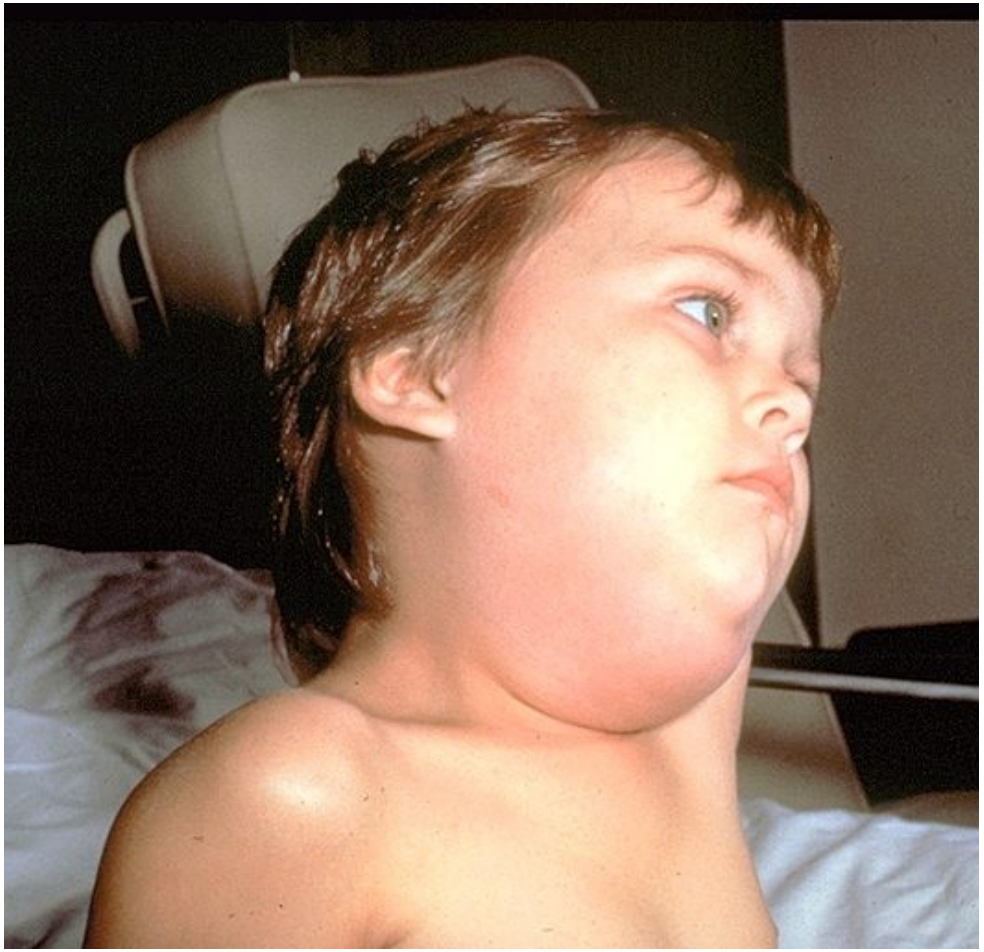
Diseases Vaccines Prevent: U.S.

- Measles
- Mumps
- Polio
- Rubella (German Measles)
- Pertussis (Whooping Cough)
- Diptheria
- Tetanus (Lockjaw)
- *Haemophilus influenzae* B (Hib)
- Hepatitis A
- Hepatitis B
- Varicella (chickenpox)
- Pneumococcus
- Influenza

And Disappearing Diseases…

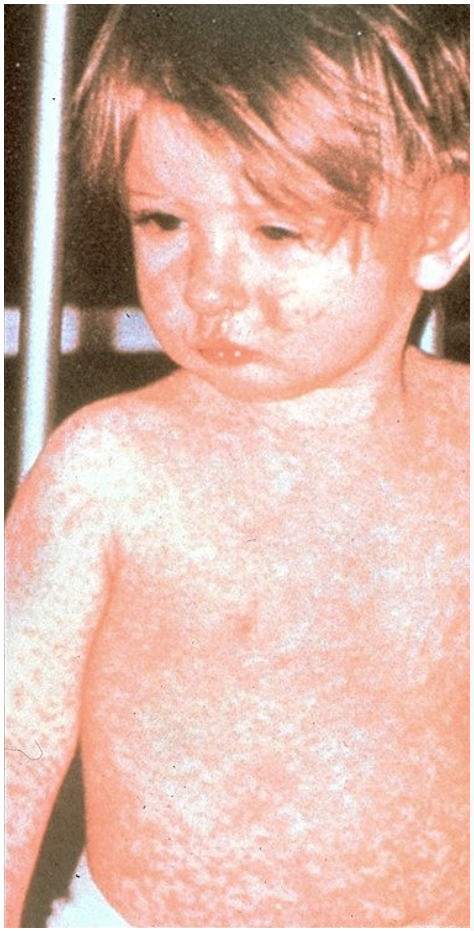


pertussis



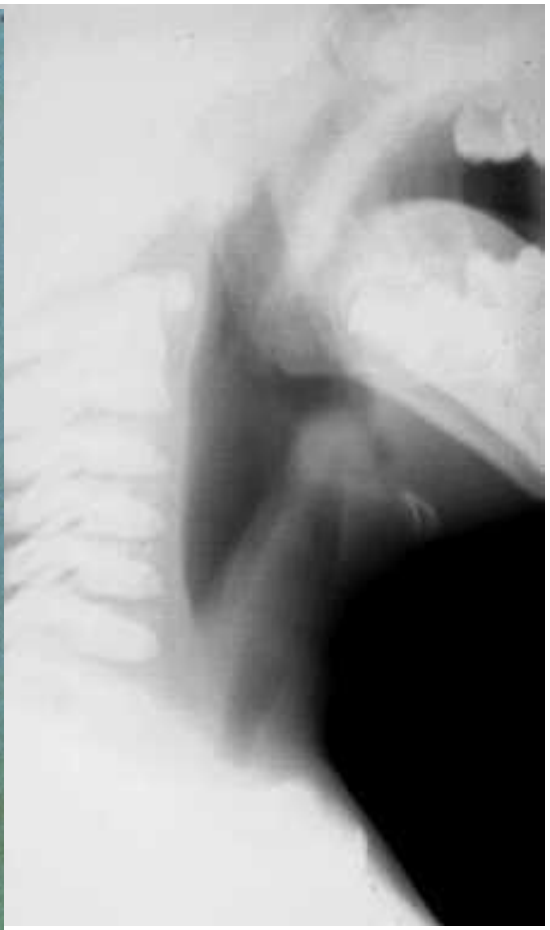
mumps

More Disappearing Diseases…



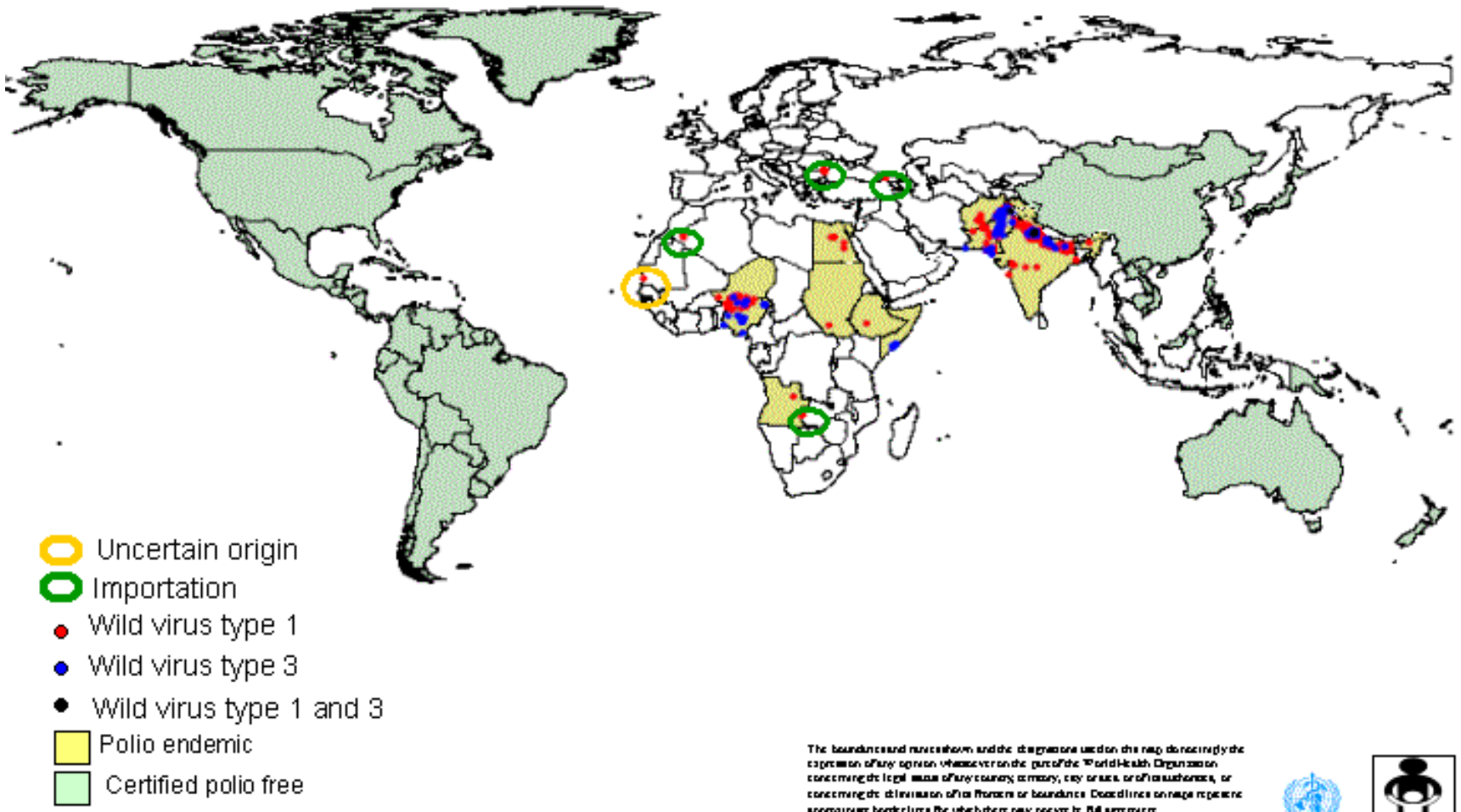
measles

polio



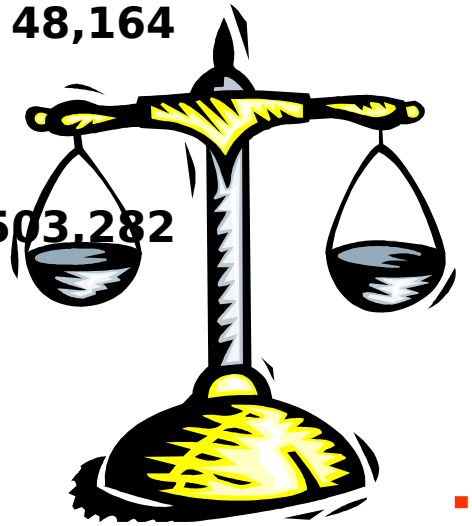
Hib

Global Polio



Comparison of Annual and Current Reported Morbidity, Vaccine-Preventable Diseases and Vaccine Adverse Events, United States

Disease	20th Century Annual Morbidity*		2001**	
Smallpox	48,164			
	0	-100		
Diphtheria	175,885		2	
	-100			
Measles	503,282			
	108	-100		
Mumps	152,209			
	231	- 99.8		
Pertussis	147,271			
	5396	- 96.3		
Polio (wild)	16,316		0	
Total	1,113,009		5,968	
Rubella	47,745			
Vaccine Adverse Events	0			
Cong. Rubella Synd.	823		2	
	99.8			
Tetanus	1,314		27	
	97.9			
Invasive Hib Disease	20,000		183	-
	99.1			



* Maximum cases reported in pre-vaccine era and year

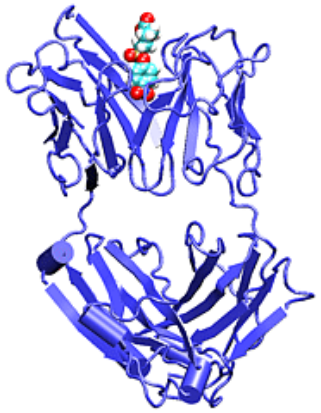
+ Estimated because no national reporting existed in the prevaccine era

Adverse events after vaccines against diseases shown on Table = 5,968

** Provisional

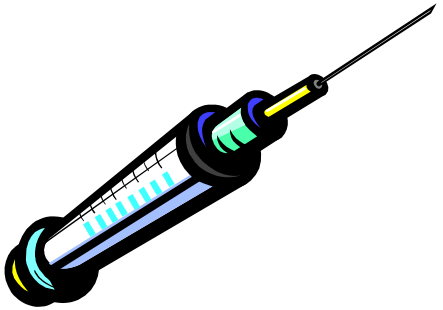
Source, CDC, MMWR 1999;48(12) and 2002;50(52)

Principles of Immunizatio n



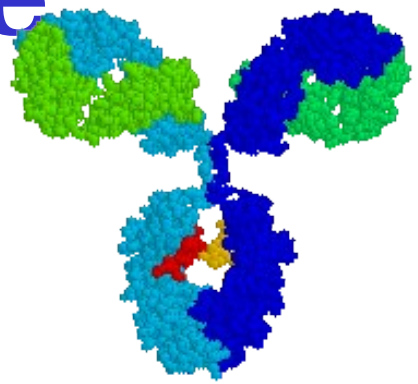
- Definitions:
  - ✓ *Immunity* – ability of body to tolerate self while eliminating foreign material
- *Antibodies* or *Immunoglobulins* – specific binding proteins that facilitate removal of foreign substances
  - ✓ *Antigens* – materials that induce the production of antibodies
  - ✓ *Immune response* –action of antibodies and helper cells that combine to eliminate antigens

Mechanisms to Acquire Immunity



- *Active* immunity
  - ✓ Immunity produced by a person's own immune response to antigen stimulus
  - ✓ Persists many **years**; often life-long
- *Passive* immunity
  - ✓ Immune protection acquired by transfer of antibody produced by another human or animal, usually by injection
  - ✓ Protection tends to wane over time as antibody degrades, usually within **months**

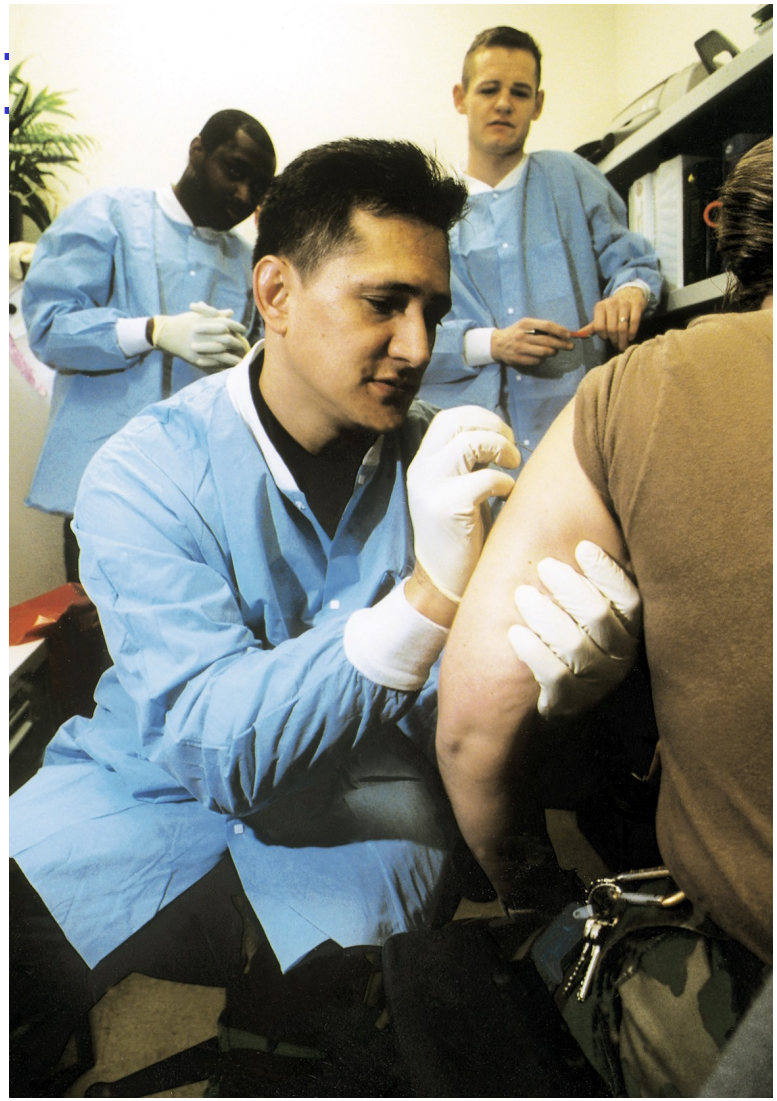
Types of Passive Immunity



- Transplacental transfer
- *Homologous pooled antibody (Ab)*
  - ✓ Used for hepatitis A and measles PEP
- *Homologous human hyperimmune Ab*
  - ✓ From persons with high-titer against specific antigens
  - ✓ E.g., Hepatitis B, rabies, tetanus, varicella, VIG
- *Heterologous hyperimmune serum (antitoxin)*
  - ✓ High-titer antibody produced in animals (usually horses) against specific antigens
  - ✓ E.g., botulinum and diptheria antitoxins, antivenins

Vaccinatio

- Stimulation of the immune system to produce a response similar to natural disease
- Usually by injection of antigens into the body
- Antigens may be inactivated (killed) or...
- Live attenuated (weakened)



General Vaccine Characteristics: *Live Attenuated Vaccines*

- Weakened viral or bacterial agents
- Replicates to produce immune response
- Often effective with only one or two doses
- Circulating antibody may blunt the response
- Vaccine potency may be unstable
- Reversion to wild type (e.g., polio) may occur and cause disease
- May be given simultaneously with other live vaccines, but if not, should wait *at least 4 weeks*

General Vaccine Characteristics: *Inactivated Vaccines*

- Subclassified into *whole cell* or *fractional*
- Not a live agent, therefore cannot replicate or cause disease
- Usually require ≥ three doses for response
- Not affected by circulating antibody
- Not generally as effective as live vaccines
- Immunity wanes; boosters required
- May be given simultaneously or together in *combination vaccines*

General Vaccine Characteristics: *Inactivated Vaccines*

- *Whole cell* vaccines
  - ✓Uses entire (killed) disease organism
  - ✓Bacterial versions no longer used in U.S; whole virion vaccines are (e.g., influenza)
- *Fractional vaccines* are protein-based or polysaccharide-based
  - ✓*Sub-unit* or *sub-virion* vaccines only use a portion of the organism
  - ✓*Toxoids* use inactivated toxins as antigen

General Vaccine Characteristics: *Polysaccharide Vaccines*

- *Pure* polysaccharide vaccines use complex carbohydrates from cell wall as antigen
  - ✓Least immunogenic; T-cell independent
  - ✓No consistent response in children < 2
  - ✓No booster response
- *Conjugate* polysaccharide vaccines combine with more antigenic molecules
  - ✓More immunogenic; T-cell dependent
  - ✓Can use in younger-aged children

General Vaccine Characteristics: *Other Vaccine Components*

- *Recombinant* vaccines use genetic engineering to:
  - ✓ acquire pure antigen for use in a sub-unit vaccine (Hep B)
  - ✓ Or to attenuate organism (oral typhoid)
- *Adjuvants* may be included in a vaccine to enhance the immune response
  - ✓ Aluminum compounds most common
  - ✓ May increase reactogenicity of vaccine

Question

1. **True statements regarding general immunization principles include which of the following**

   a. the simultaneous administration of multiple vaccines decrease effectiveness

   b. immunoglobulin preceding a live virus vaccination may interfere with the immune response

   c. URI with low grade fever is a relative contraindication for immunization

   d. missed immunizations require re-starting the series

Spacing of Vaccine Doses

Combination interval	Recommended
≥ 2 inactivated vaccines simultaneous	None, or
Inactivated and live vaccine	None, or simultaneous
> 2 live parenteral vaccines	4-week min. interval if not simultaneous*
Antibody product and inactivated antigen time	None, or simultaneous @ two sites or any
Antibody and live antigen	Do not give together

*exception, smallpox and varicella

Spacing of Vaccine Doses

Combination	Recommended interval
Antibody after inactivated	None, or simultaneous
Live vaccine after antibody	Minimum 3 mos.*
Antibody after live vaccine	2-weeks
PPD (TST) and MMR	Simultaneous best; else TST 4 weeks after MMR

* *Anti-Rho(D) globulin does not preclude MMR post-partum*

General Recommendations

- *Lapsed vaccination schedules*
  - ✓Give as soon as recognized
  - ✓NO NEED TO RESTART SERIES
  - ✓Do not compress schedules
- *Unkown vaccination status*
  - ✓Accept only written documents or serologic verification
  - ✓Otherwise vaccinate on age schedule

Question

2. Which one of the following is the preferred site for IM injection of medication or vaccines in infants?

a. anterolateral thigh

b. buttock

c. upper arm

d. upper abdomen

General Recommendations

- *Route and site of vaccination*
  - ✓Give as in FDA package insert
  - ✓Changing route may alter response
  - ✓Two or more injections: alternate sites
  - ✓Thigh preferred in infants; deltoid in adults
- *Premature infants*
  - ✓Vaccinate on *chronological age* schedule like full-term infants

General Recommendations

- *Pregnancy*
  - ✓No confirmed risk for inactivated vaccines or toxoids (defer anthrax if no exposure)
  - ✓Td and influenza indicated in pregnancy
  - ✓Avoid live vaccines (give YFV if at risk)
- *Lactation*
  - ✓Usually no contraindication for any inactivated or live vaccine
  - ✓Exception: smallpox vaccine pre-outbreak

Vaccination records

- National Childhood Vaccine Injury Act (NCVIA) of 1986 requires documenting:
  - ✓Vaccine information sheet (VIS), edition
  - ✓Date vaccine administered
  - ✓Vaccine lot number
  - ✓Name address and title of administrator

VIS
Vaccine Information Sheets

LIVE, INTRANASAL INFLUENZA VACCINE

WHAT YOU NEED TO KNOW

2003-2004

1 Why get vaccinated?

Influenza ("flu") is a serious disease.

It is caused by a virus that spreads from infected persons to the nose or throat of others.

Influenza can cause:

- fever
- cough
- sore throat
- headache
- chills
- muscle aches

Anyone can get influenza. Most people are ill with influenza for only a few days, but some get much sicker and may need to be hospitalized. Influenza causes an average of 36,000 deaths each year in the U.S., mostly among the elderly.

Influenza vaccine can prevent influenza.

2 Live, intranasal influenza vaccine

Two types of influenza vaccine are now available. Live, intranasal influenza vaccine (trade-name FluMist™) was licensed in 2003. FluMist is an attenuated (weakened) live vaccine. It is sprayed into the nostrils

4 Who should *not* get live, intranasal influenza vaccine?

The following people should not get intranasal influenza vaccine. They should check with their health care provider about getting **inactivated influenza vaccine**.

- **Adults 50 years of age or older** or **children younger than 5**.
- People who have **long-term health problems** with:
  - heart disease
  - kidney disease
  - lung disease
  - metabolic disease, such as diabetes
  - asthma
  - anemia, and other blood disorders
- People with a **weakened immune system** due to:
  - HIV/AIDS or another disease that affects the immune system
  - long-term treatment with drugs that weaken the immune system, such as steroids
  - cancer treatment with x-rays or drugs
- Children or adolescents on **long-term aspirin treatment** (these people could develop Reye syndrome if they catch influenza).
- **Pregnant women**.
- Anyone with a history of **Guillain-Barré Syndrome** (GBS).

Vaccine Information Sheets (VIS)

- Mandated for certain child vaccines by the National Childhood Vaccine Injury Act
  - ✓31% of pediatrician nationally reported not using the VIS
  - ✓Time considered a significant barrier
  - ✓Multifaceted interventions, including exam room posters, significantly increased VIS use and discussion

Ambul Pediatr 2002 May-Jun;2(3):193-200

Contraindications

- *Contraindications* greatly increase the chance of a serious adverse event (AE)
  - ✓Only two permanent:
    - Severe allergic reactions to vaccine or component
    - Encephalopathy within 7 days of pertussis
    - Pregnancy and immunosuppression are *temporary* contraindications for live vaccines
  - ✓Mild illnesses are NOT contraindications
    - Includes low fever, URI, otitis, diarrhea, Abx

Precautions

- *Precautions* may increase chance or severity of AE or reduce immune response
  - ✓ Permanent precautions for pertussis:
    - Fever>105
    - Collapse or shock-like state
    - Inconsolable crying >3 hrs. within 48 hrs.
    - Seizure within 3 days of a dose
  - ✓ Precautions do not obviate vaccination if known exposure to disease and risk is high

Acute Vaccine Reactions

- Anaphylaxis (severe allergic reaction)
  - ✓Incidence < 1 in 500,000
  - ✓Hypotension, dyspnea, hives, edema
  - ✓Rx: epinephrine 1:1000, O_2, airway
  - ✓May be idiopathic or due to vaccine component (antigen, preservatives, egg protein, gelatin, etc.)
- Vasovagal syncope
  - ✓Place in recumbent position

Vaccine Adverse Events

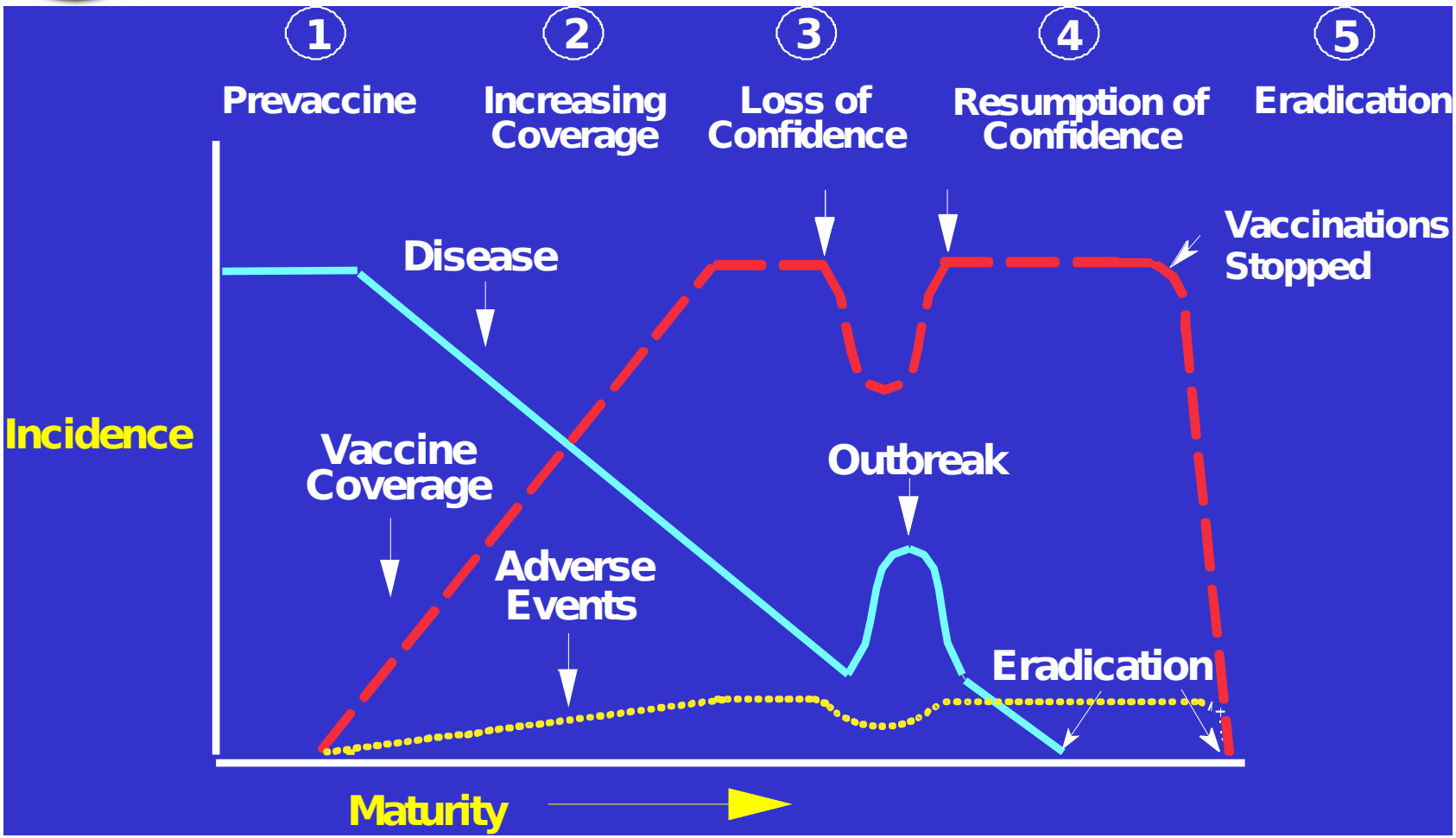
- *Adverse reactions* are extraneous side effects shown to be*caused* by a vaccine
  - ✓Most common are local side-effects
- *Adverse events* are anything untoward occurring in time following vaccination
  - ✓Note: “sequence” ≠ “consequence”
    - ➢AE’s may be either caused by vaccine or simply coincidental
    - ➢Causality suggested if biologically plausible, recurrent, etc.

Importance of Vaccine Safety

- Higher standards of safety now expected
  - ✓ “first do no harm”
  - ✓ Public health expectations>>clinical medicine due to different risk-benefit perception
    - Vaccinees generally healthy
    - Universal vaccine recommendations
    - Uncertain perception of threat due to herd immunity or unknown probability (BW agents)
- Lower risk tolerance = search for rare reactions
- Studies of rare events more costly, less definitive

Ref. CDC, Epidemiology and Prevention of Vaccine Preventable Diseases

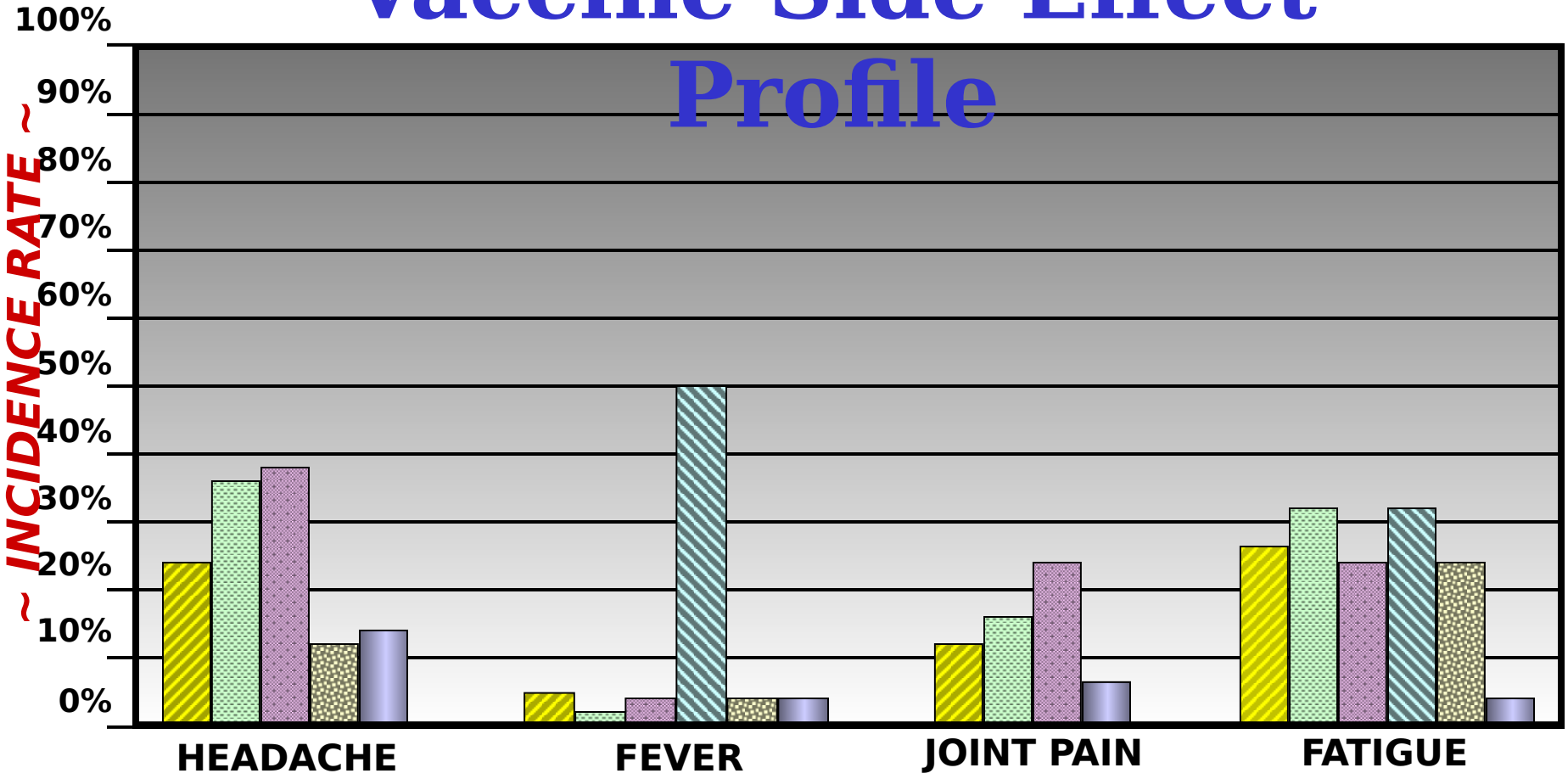
Evolution of Immunization Prog and Prominence of Vaccine Safe



Examples: Smallpox, Oral Polio Vaccine

From: Chen, CDC

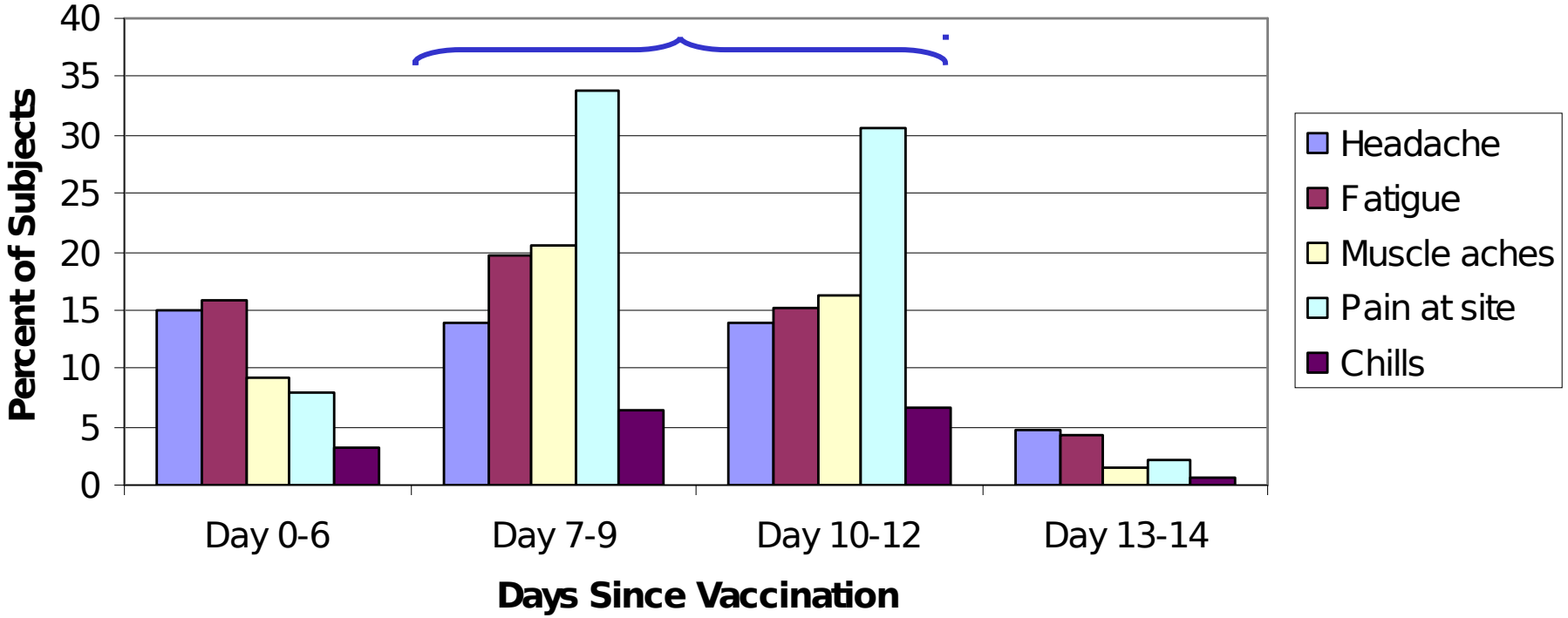
Vaccine Side Effect Profile



NOTE: ***ANTHRAX RATES DERIVED FROM COMBINED EXPERIENCE OF TAMC-600 SURVEY AND USAMRIID REDUCED DOSE STUDY***

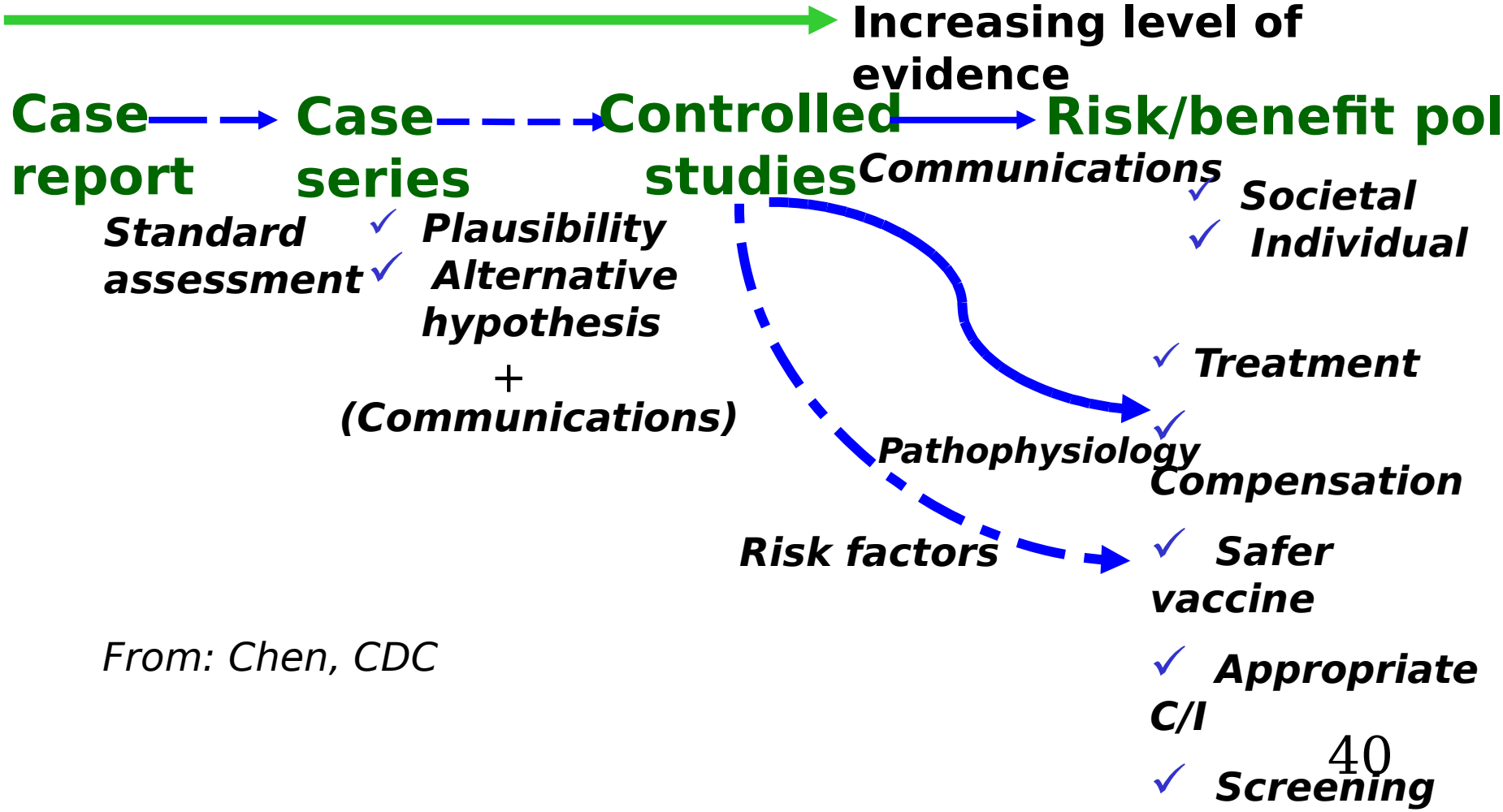
Frequency of Moderate to Severe Symptoms After Primary Smallpox (Vaccinia)

Reactogenicity peaks days 7 through day 12



Adapted from Frey, et al. NEJM 2002;346:1265-74. (Example of IND trial)

Life Cycle of a Vaccine Safety Concern



From: Chen, CDC

Post-licensure Vaccine Safety

- Spontaneous reports (e.g.,Vaccine Adverse Event Reporting System (VAERS))
- Phase IV trials N~10,000 subjects
- Controlled epidemiologic studies
  - ✓ Ad hoc, case-control studies (e.g., rotavirus and intussusception)
  - ✓ Pre-established, large-linked databases
    - Combine immunization registries and health outcome databases in large healthcare organizations
    - More efficient to evaluate rare outcomes
    - Causality assessments complicated by adequate controls

Ref. CDC, Epidemiology and Prevention of Vaccine Preventable Diseases

Vaccine Safety Monitoring:

VACCINE SAFETY MONITORING

aintain Public Confidence in Immunization Progran

VAERS
Hypothesis Generation
Could Vaccine Cause AE?

IOM/AVEC/SVEC
Hypothesis Evaluation
Level of PH Concern?

CISA/VHC
Hypothesis Clarification
Clinical Syndromes?

VSD/DMSS
Hypothesis Testing
Did Vaccine Cause AE?

RISK COMMUNICATIONS
Disseminating Results

VACCINE DEVELOPMENT
Ensure safer Vaccination

VAERS Limitations

- "Passive" surveillance
  - ✓ Prone to underreporting
  - ✓ Cannot get a true rate of adverse events
    - No real denominator available
    - Only rate available is "reporting rate"
    - May be subject to bias (emphasis, media)
  - ✓ Limited to confirmation or "signal detection" :
    - confirmation of known associated events
    - Identification of possible lot contamination
    - Hypothesis generation about suspected events

VAERS

Available at www.vaers.org
Use low threshold for reporting

Causality does NOT need to be predetermined

WEBSITE: www.vaers.org E-MAIL: info@vaers.org FAX: 1-877-721-0366

VACCINE ADVERSE EVENT REPORTING SYSTEM
24 Hour Toll-Free Information 1-800-822-7967
P.O. Box 1100, Rockville, MD 20849-1100
PATIENT IDENTITY KEPT CONFIDENTIAL

For CDC/FDA Use Only
VAERS Number _____
Date Received _____

Patient Name:
Last First M.I.
Address
City State Zip
Telephone no. (____) _____

Vaccine administered by (Name):
Responsible Physician _____
Facility Name/Address
City State Zip
Telephone no. (____) _____

Form completed by (Name):
Relation to Patient ☐ Vaccine Provider ☐ Patient/Parent ☐ Manufacturer ☐ Other
Address *(if different from patient or provider)*
City State Zip
Telephone no. (____) _____

1. State | 2. County where administered | 3. Date of birth mm dd yy | 4. Patient age | 5. Sex ☐ M ☐ F | 6. Date form completed mm dd yy

7. Describe adverse events(s) (symptoms, signs, time course) and treatment, if any

8. Check all appropriate:
☐ Patient died (date mm dd yy)
☐ Life threatening illness
☐ Required emergency room/doctor visit
☐ Required hospitalization (_____days)
☐ Resulted in prolongation of hospitalization
☐ Resulted in permanent disability
☐ None of the above

9. Patient recovered ☐ YES ☐ NO ☐ UNKNOWN

10. Date of vaccination mm dd yy AM Time _____ PM

11. Adverse event onset mm dd yy AM Time _____ PM

12. Relevant diagnostic tests/laboratory data

13. Enter all vaccines given on date listed in no. 10

	Vaccine (type)	Manufacturer	Lot number	Route/Site	No. Previous Doses
a.					
b.					
c.					
d.					

14. Any other vaccinations within 4 weeks prior to the date listed in no. 10

	Vaccine (type)	Manufacturer	Lot number	Route/Site	No. Previous doses	Date given
a.						
b.						

15. Vaccinated at:
☐ Private doctor's office/hospital ☐ Military clinic/hospital
☐ Public health clinic/hospital ☐ Other/unknown

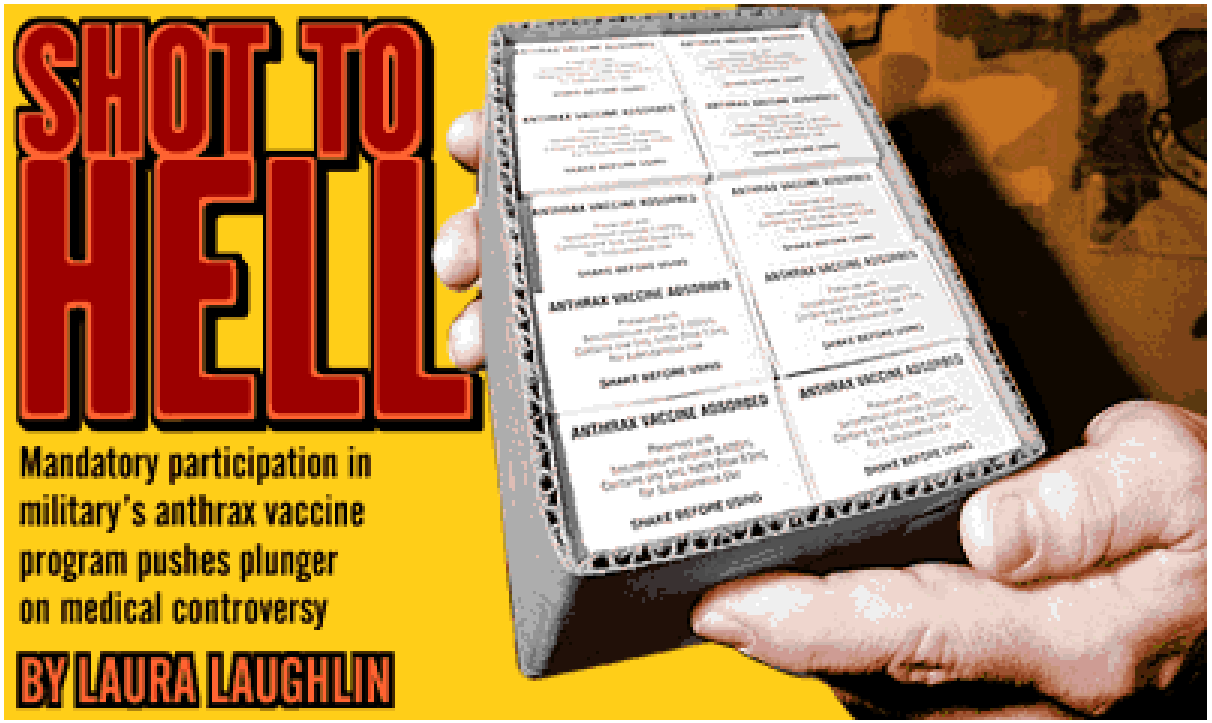
16. Vaccine purchased with:
☐ Private funds ☐ Military funds
☐ Public funds ☐ Other/unknown

17. Other medications

18. Illness at time of vaccination (specify)

19. Pre-existing physician-diagnosed allergies, birth defects, medical conditions (specify)

Rumor vs Research



"A lie will travel halfway around the world before the truth pulls on its boots"

Mark Twain

Vaccines, Mercury, and Autism in California by

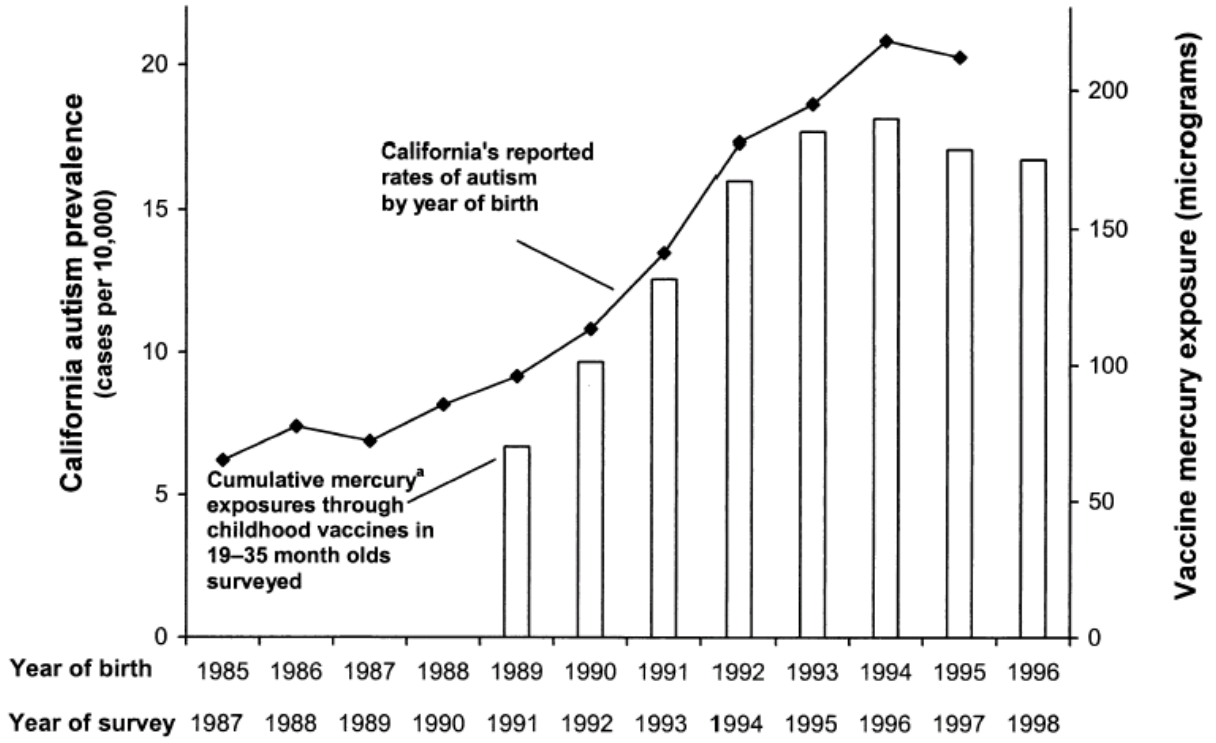


Figure 1. Graphical ecologic analysis presented by Blaxill[3] to the Institute of Medicine on July 16, 2001, comparing the estimated average cumulative dose of mercury exposure in the United States from vaccines, and the estimated prevalence (per 10,000 population) of children diagnosed with autism-like disorders seeking special education services for autism in California from 1987 to 1998, by birth-year cohort.

[a]Includes DPT, *Haemophilus influenza* B, and hepatitis B exposures weighted by survey year compliance.

Vaccines, Mercury, and Autism in Denmark by Birth Cohort

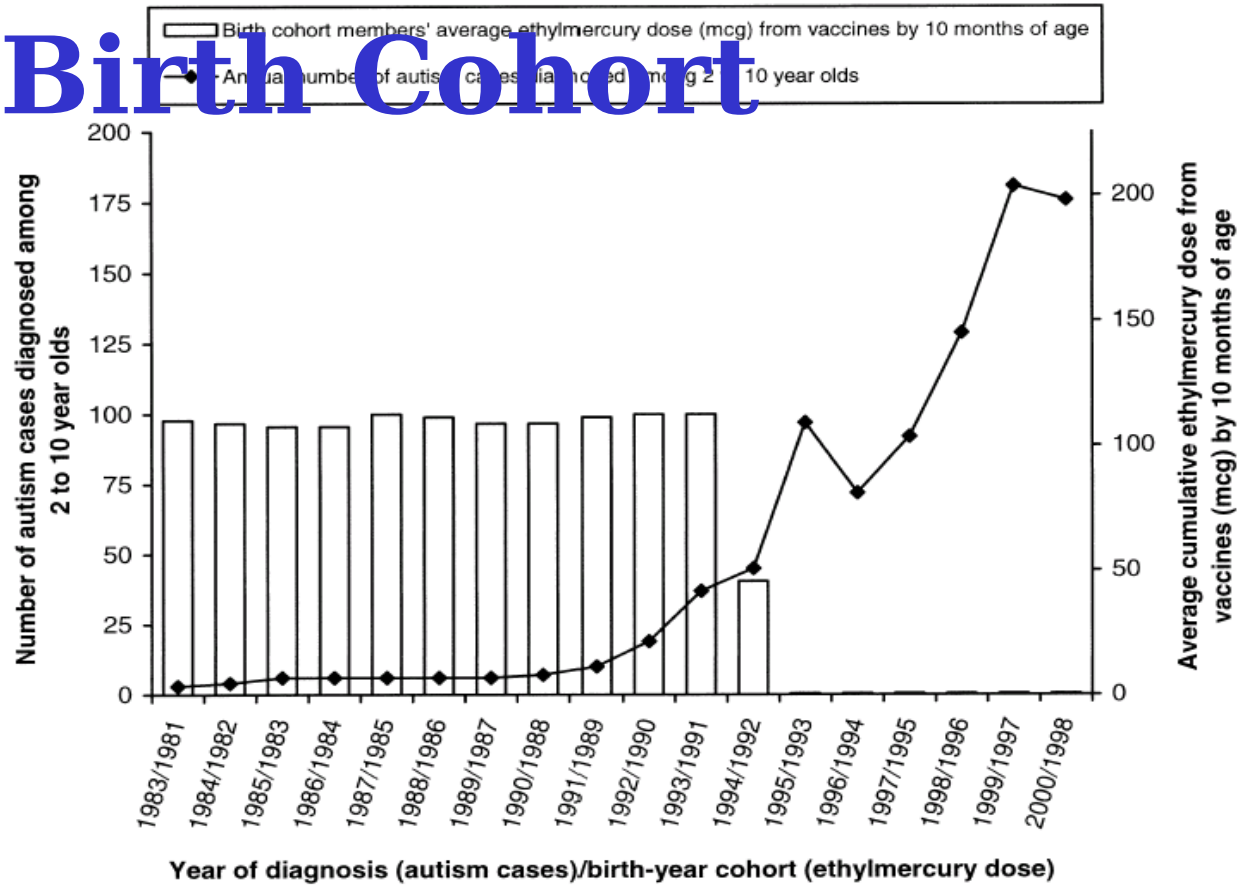


Figure 3. Graphical ecologic analysis comparing the average cumulative ethylmercury dose received from vaccines by birth-year cohort from 1981 to 1998, and the annual number of incident cases of autism in children aged 2 to 10 years diagnosed in Denmark from 1983 to 2000.

HEALTH

Report: No link between autism, vaccines

Wednesday, May 19, 2004 Posted: 8:00 AM EDT (1200 GMT)

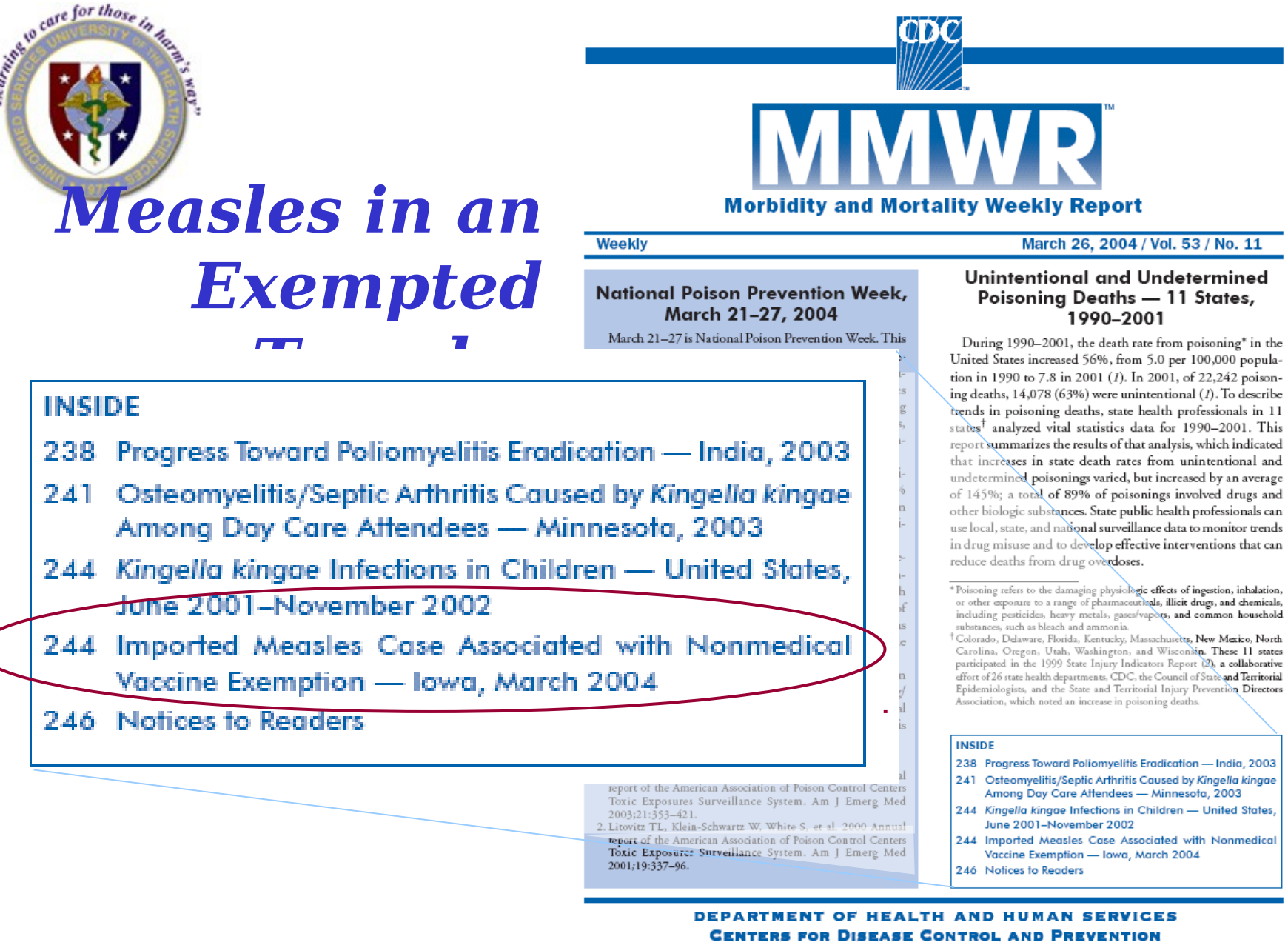
WASHINGTON (AP) -- There is no evidence that a controversial mercury-based vaccine preservative causes autism, concludes an eagerly anticipated scientific review that says it's time to lay vaccine suspicions to rest and find the real culprit.

Tuesday's conclusion by the prestigious Institute of Medicine pointed to five large studies, here and abroad, that tracked

Examples Rumors, Vaccines, and Disease

- 1899 during Boer War, British develop typhoid vaccine for use in military
  - ✓ Opposition grows to vaccine
  - ✓ Only 14,000 take vaccine, with 2% infection rate
  - ✓ Among unvaccinated, 14% infection rate, with 58,000 cases and 9,000 deaths
- In 1974 Japan had 393 cases of pertussis with 80% of children vaccinated
  - ✓ Rumors spread vaccine not needed and not safe
  - ✓ In 1976, only 10% vaccinated
  - ✓ In 1979, epidemic of 13,000 cases, 41 deaths

Measles in an Exempted



MMWR
Morbidity and Mortality Weekly Report
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National Poison Prevention Week, March 21–27, 2004
March 21–27 is National Poison Prevention Week. This

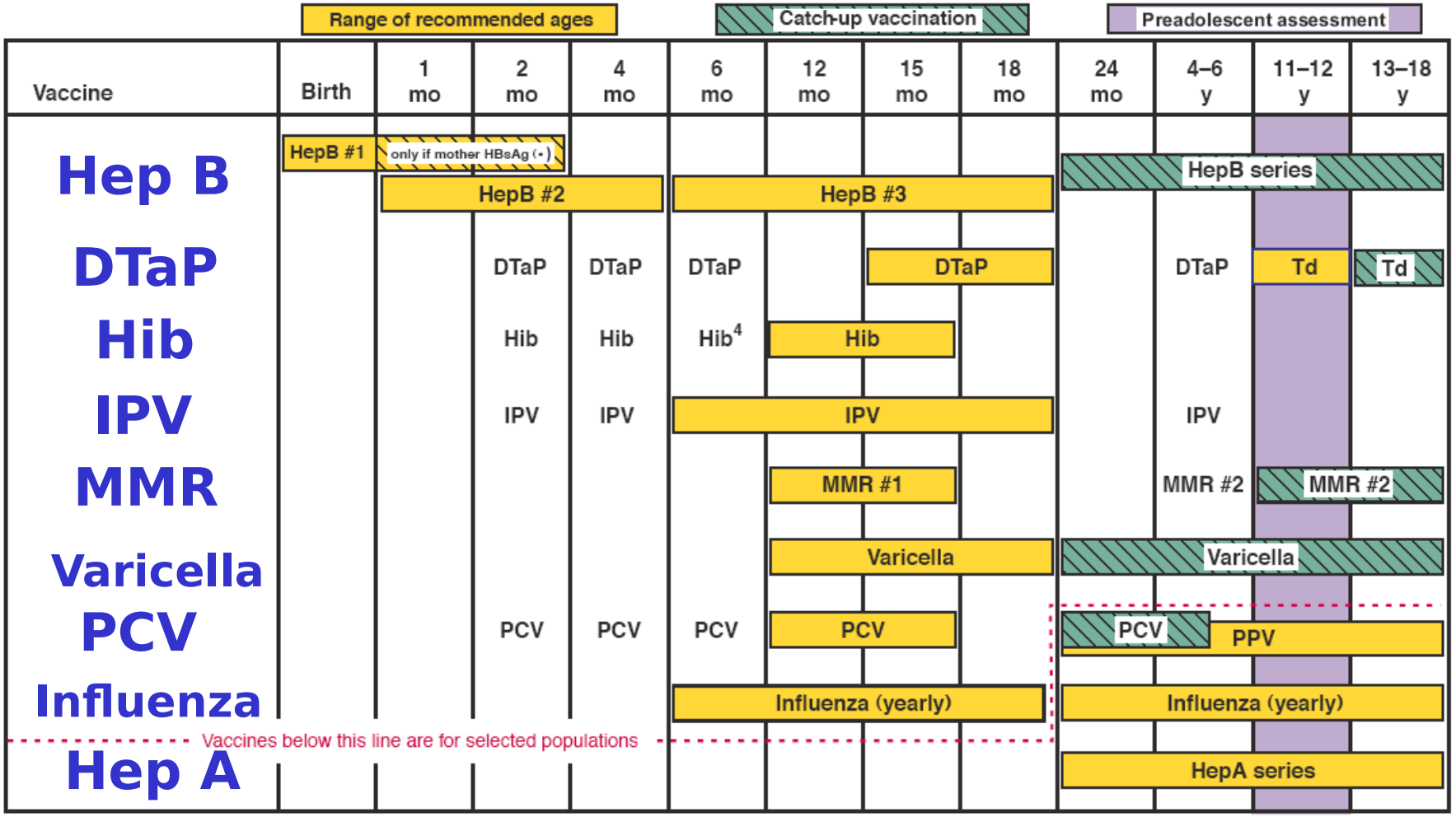
Unintentional and Undetermined Poisoning Deaths — 11 States, 1990–2001
During 1990–2001, the death rate from poisoning* in the United States increased 56%, from 5.0 per 100,000 population in 1990 to 7.8 in 2001 (*1*). In 2001, of 22,242 poisoning deaths, 14,078 (63%) were unintentional (*1*). To describe trends in poisoning deaths, state health professionals in 11 states† analyzed vital statistics data for 1990–2001. This report summarizes the results of that analysis, which indicated that increases in state death rates from unintentional and undetermined poisonings varied, but increased by an average of 145%; a total of 89% of poisonings involved drugs and other biologic substances. State public health professionals can use local, state, and national surveillance data to monitor trends in drug misuse and to develop effective interventions that can reduce deaths from drug overdoses.

* Poisoning refers to the damaging physiologic effects of ingestion, inhalation, or other exposure to a range of pharmaceuticals, illicit drugs, and chemicals, including pesticides, heavy metals, gases/vapors, and common household substances, such as bleach and ammonia.
† Colorado, Delaware, Florida, Kentucky, Massachusetts, New Mexico, North Carolina, Oregon, Utah, Washington, and Wisconsin. These 11 states participated in the 1999 State Injury Indicators Report (2), a collaborative effort of 26 state health departments, CDC, the Council of State and Territorial Epidemiologists, and the State and Territorial Injury Prevention Directors Association, which noted an increase in poisoning deaths.

report of the American Association of Poison Control Centers Toxic Exposures Surveillance System. Am J Emerg Med 2003;21:353–421.
2. Litovitz TL, Klein-Schwartz W, White S, et al. 2000 Annual report of the American Association of Poison Control Centers Toxic Exposures Surveillance System. Am J Emerg Med 2001;19:337–96.

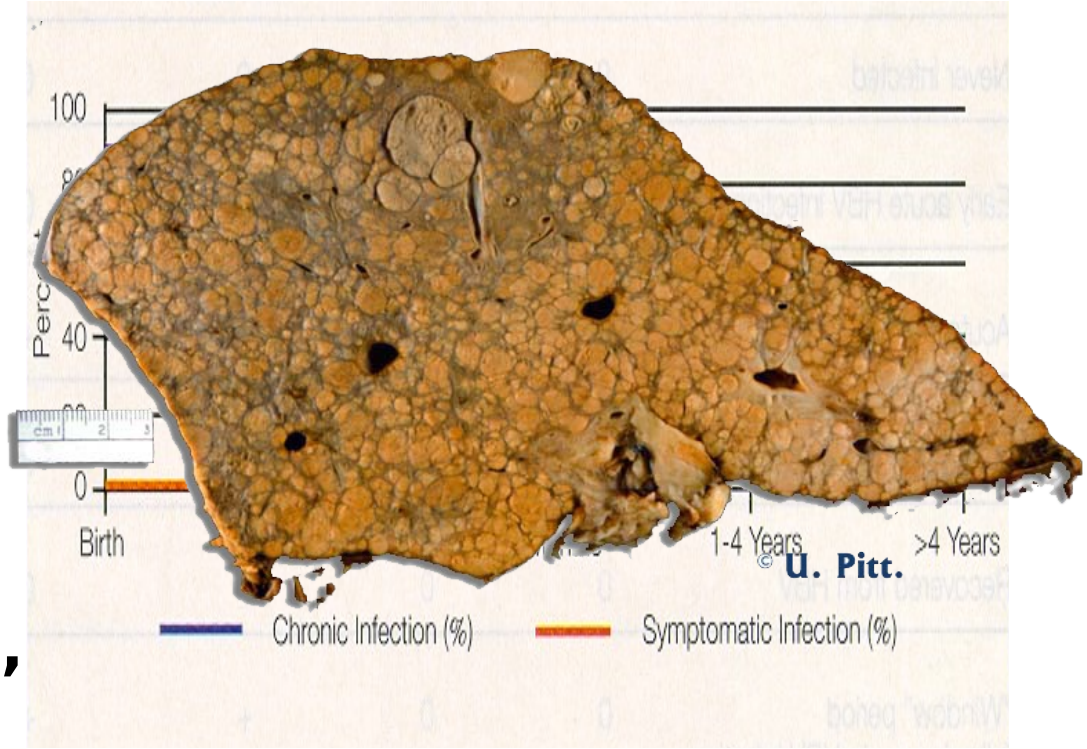
DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

2004 Child and Adolescent



Hepatitis B - Why Immunize?

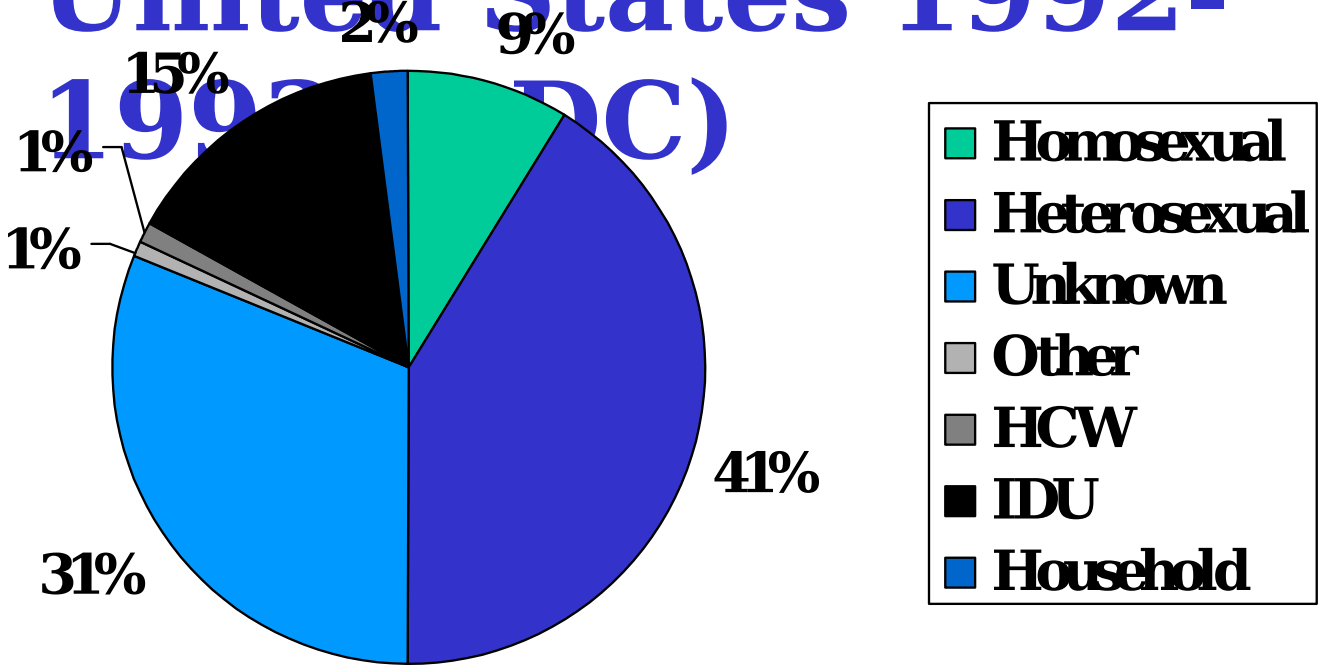
- > 200 M carriers worldwide
- chronic infection most likely if infected as an infant, usually unrecognized
- Causes chronic hepatitis, cirrhosis, ~ 80% hepatic CA



Hepatitis B Perinatal Transmission

- If mother positive for HBsAg and HBeAg
  - ✓70-90% of infants infected
  - ✓90% of infected become chronic carriers
- If positive HBsAg only
  - ✓20% of infants infected
  - ✓90% of infected become chronic carriers

Risk Factors for Hepatitis B United States 1992-1993 (CDC)



Hepatitis B Vaccine

- **Vaccine type: inactivated, recombinant hepatitis B surface antigen (HBsAg)**
- **Efficacy: 95% (80-100%)**
- **Human serum derived vaccine (Heptavax®) no longer used in U.S.**
- **Duration of immunity > 15 years**
- **Schedule: 3 doses children, 2 doses adolescents**
- **Recombivax® and Engerix® interchangeable for 3 dose schedules**

Hepatitis B Immunization Schedule

Age → / Vaccine ↓	Birth	1-6 mo	1-4 yrs	11-12 yrs	13-18 yrs	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	18 yrs
Hepatitis B	Hep B #1	if HBsAg -					Hep B #2		Hep B #3		Hep B series		

2 dose series for adolescents 11-15 y/o

Question

3. The serologic picture consistent with immunity acquired by Hepatitis B immunization is:

a. + HBsAb / + HBcAb

b. – HBsAb / + HBcAb

c. + HBsAb / - HBcAb

d. – HBsAb / - HBcAb

e. none of the above

Hepatitis B Serology

- + HBsAb / - HBcAb indicates vaccine induced immunity

- + HBsAb / + HBcAb indicates naturally acquired immunity

Hepatitis B Immunoprophylaxis to Prevent Perinatal Transmission

Infant Born to HBsAg Positive Mother :

Vaccine Dose and HBIG	Age
First	Birth (w/in 12 hrs)
HBIG	Birth (w/in 12 hrs)
Second	1-2 mo
Third	6 mo

COMVAX

- Hepatitis B-Hib combination vaccine
- Use when either antigen indicated
- Note: CANNOT use < 6 weeks of age (possible suppression of immune response to Hib component)
- Therefore cannot use if mother HBsAg+

Diphtheria - Tetanus – Pertussis *(The alphabet soup)*

- **DTP (DTwP) or DTaP**
  - ✓ **D: diphtheria toxoid (more toxoid)**
  - ✓ **d: diphtheria toxoid (less toxoid)**
  - ✓ **T: tetanus toxoid**
  - ✓ **(w)P: pertussis, whole-killed organism**
  - ✓ **aP: pertussis, acellular (specific pertussis antigens)**
  - ✓ **DT used through age 6**
  - ✓ **Adult Td used age 7 and older**

Diphtheria-Tetanus-Pertussis Immunization Schedule

Age ⇨ / Vaccine ⇩	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	4-6 yrs
Diphtheria, Tetanus Pertussis [2]			DTaP	DTaP		DTaP	DTaP	Td	

11-12 yrs	13-18 yrs
DTaP	

DTaP is the preferred preparation for all doses, use same brand for all doses (DAPTACEL, Infanrix, Tripedia)

Type: combination, inactivated acellular toxoid

If first dose < 12 mos, 4 doses recommended

If first dose > 12 mos, 3 doses = primary series

DTaP Common Adverse Events

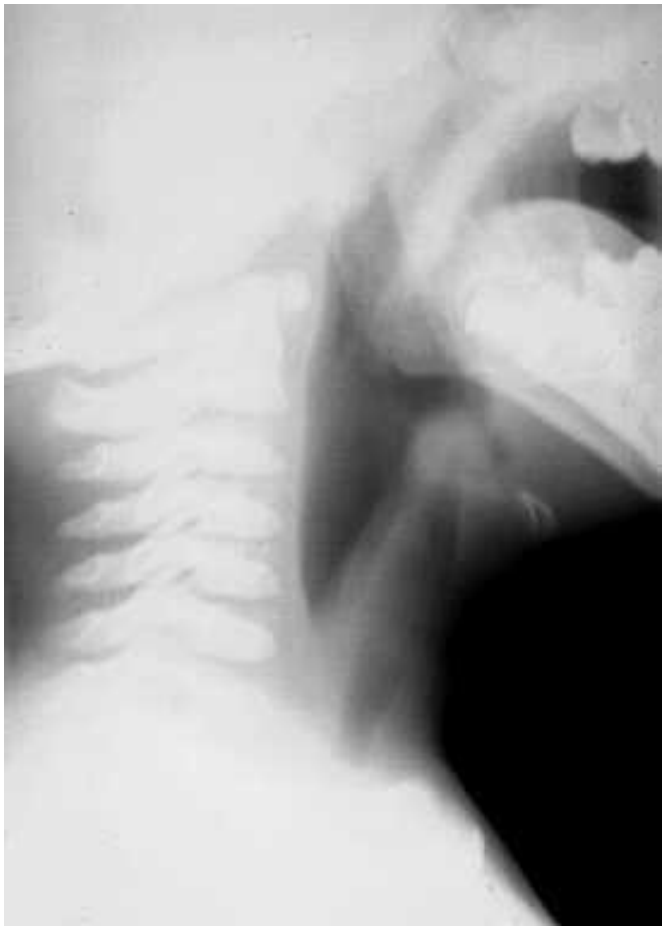
- local / febrile reactions
  - ✓erythema, tenderness, swelling
  - ✓slight-to-moderate fever
  - ✓sterile abscess
- more likely w/ subsequent doses
- less common w/ DTaP

Uncommon Adverse Events

- **Precautions (not contraindications)**
  - ✓ **convulsions w/ or w/o fever**
  - ✓ **persistent inconsolable screaming/unusual high pitched cry**
  - ✓ **hypotonic-hyporesponsive episode (HHE)**
  - ✓ **temp ≥ 105°F (40.5° C)**
- **all less common with DTaP**

Haemophilus influenzae

- 6 distinct capsular types
  - ✓ type b associated with 95% of invasive disease (meningitis, epiglottitis)
  - ✓ CFR 2-5%; 15-30% meningitis sequelae
- infection risk greatest ⇒ 3 mos - 3 yrs old
- many non-encapsulated strains
  - ✓ commonly cause otitis, sinusitis, conjunctivitis



Hib Vaccine

- Three vaccines approved for infant use (Pedvax HIB, HibTiTER, ActHIB)
- All consist of H. flu type b capsular polysaccharide linked to protein carrier (conjugate vaccines)
- Interchangeable for primary series or booster
- No benefit in preventing disease due to non-typable strains
- Combination vaccines: TriHIBit, COMVAX

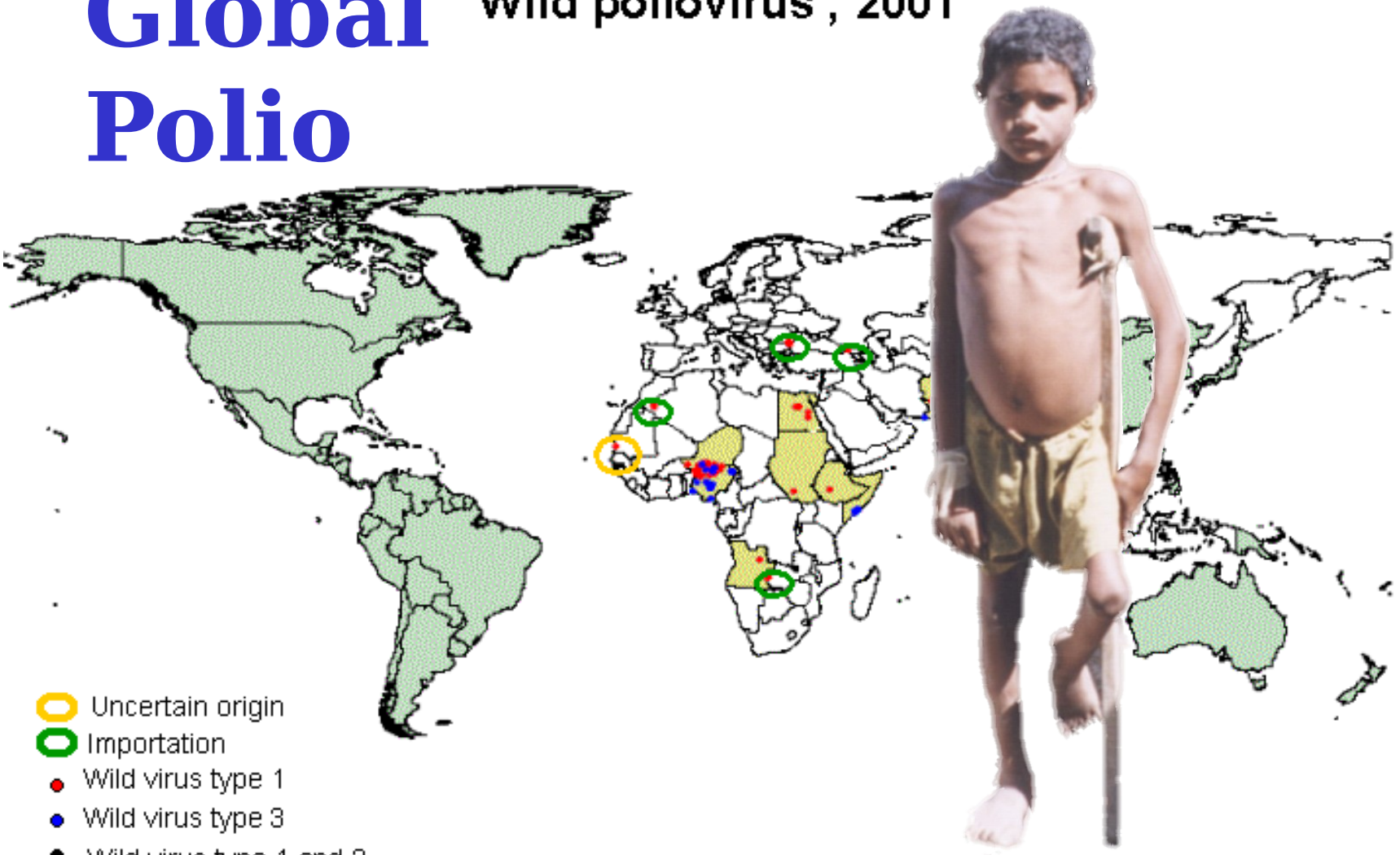
Haemophilus influenzae Immunization Schedule

Age → / Vaccine ↓	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	4-6 yrs	11-12 yrs	13-18 yrs
H. flu type b [3]											
HibTITER®			Hib		Hib	Hib	Hib				
ActHIB®											
PedvaxHIB®			X		X	X					
COMVAX®				X							

Conjugate Hib vaccines are not recommended after 5 years age
PedvaxHIB, COMVAX given at 2, 4 mos do not require 6 mo dose

Global Polio

Wild poliovirus , 2001



Question

3. Which of the following regimens is currently recommended for routine childhood polio immunization?

a. OPV at 2, 4, 12-18 mo and 4-6 yrs

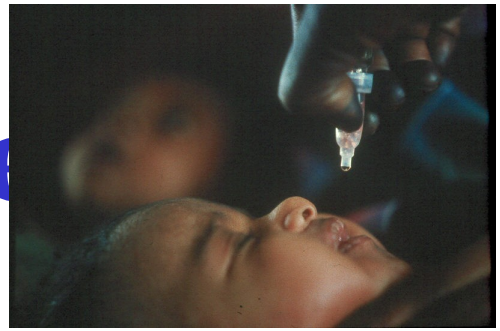
b. IPV at 2, 4, 12-18 mo, 4-6 years

c. IPV at 2, 4 mo, OPV at 12-18 mo and 4-6 yrs

d. OPV at 2, 4 mo, IPV at 12-18 mo and 4-6 yrs

e. all of the above are appropriate options.

Polio Vaccine

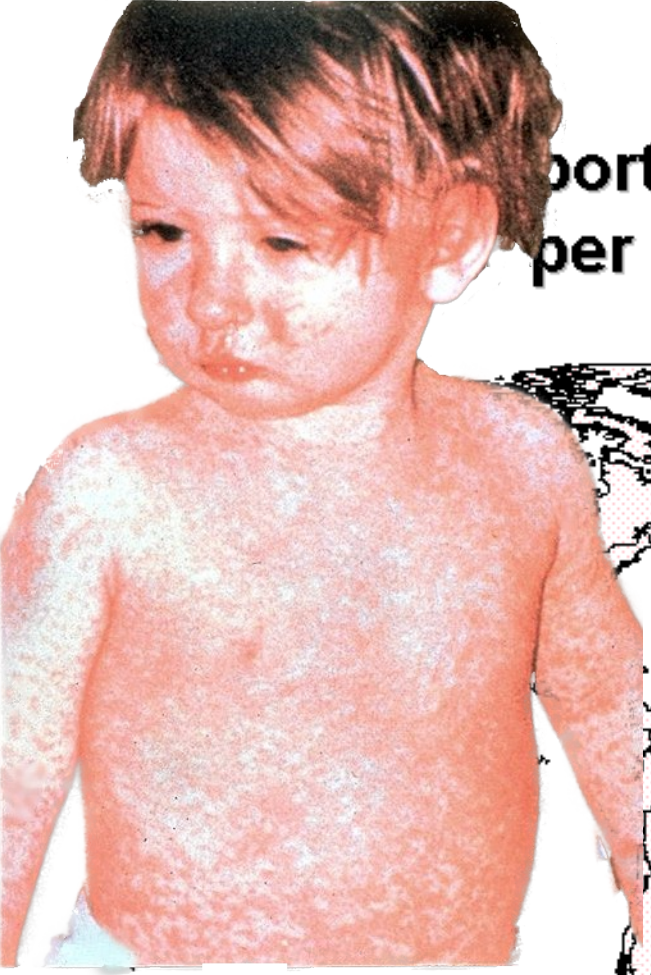


- **IPV - Inactivated Polio Virus**
  - ✓ **inactivated, enhanced potency**
  - ✓ **parenteral admin (another shot!)**
- **OPV - Oral Polio Virus**
  - ✓ **live, attenuated viruses, trivalent**
  - ✓ **viral shedding**
  - ✓ **associated with VAPP (Vaccine Acquired Paralytic Polio)**
  - ✓ **No longer recommended routinely in U.S.**

Polio Immunization Schedule

Age ⇨ / Vaccine ⇩	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	4-6 yrs	11-12 yrs	13-18 yrs
Polio[4]			IPV		IPV	IPV			IPV	IPV	

all-IVP schedule recommended by ACIP/AAP/AAFP



oorted measles incidence rates per 100,000 population, 2001

- <1 per 100 000
- 1 - 9 per 100 000
- 10 - 99 per 100 000
- Over 100 per 100 000
- No data reported

Source: WHO/UNICEF joint reporting form, 2001

Measles, Mumps & Rubella

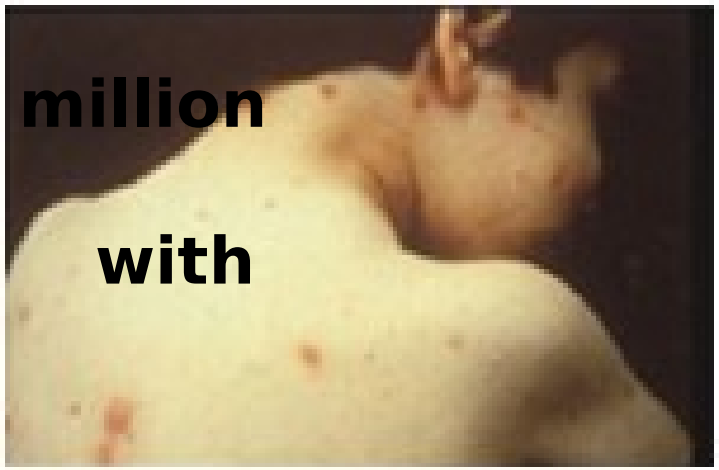
- **live attenuated virus (all three components)**
- **rash, fever, adenopathy not uncommon after vaccination**
  - ✓**7-14 days after vaccination**

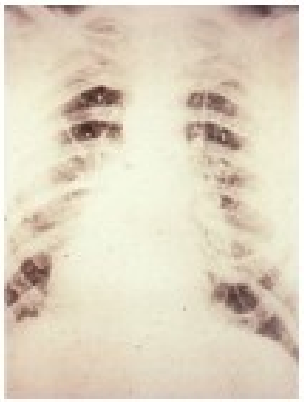
Measles-Mumps-Rubella (MMR) Immunization Schedule

Age → / Vaccine ↓	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	4 yrs
		6 mo-11 yrs	12-12 yrs	13-18 yrs					
Measles, Mumps Rubella[5]					MMR #1		MMR #2	MMR #2	

Varicella - Why Immunize?

- high attack rate: 4 million cases/yr
- 150-200,000 patients with complications
- serious complications
  - ✓10,000 hospitalizations
  - ✓100 deaths annually
- more severe w/advancing age
- Required by law (many states)





X-ray of Pneumonia caused by varicella.

CDC

Varicella Vaccine

- live attenuated virus
- highly immunogenic
  - ✓70-90% effective in preventing dz
  - ✓>95% effective in preventing severe dz
- persistent immunity
- 4-5 times ⇓ risk of shingles
- Should not be given to immune suppressed (exceptions: humoral deficiency or Asx HIV+ children)

Varicella Immunization

Age ⇨ / Vaccine ⇩	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	4-6 yrs	11-12 yrs	13-18 yrs
Varicella[6]					Varicella		Varicella				

Post-exposure vaccination also recommended (use within 3-5 days of exposure)

S. pneumoniae Conjugate Vaccine (PCV

- ***S. pneumoniae*** **leading cause of meningitis in kids < 5 y/o**
- **conjugated vaccine (Prevnar®)**
  - ✓ **capsular polysaccharide-protein**
- **7-valent vaccine**
  - ✓ **80% of serotypes responsible for invasive disease**

S. pneumoniae **Conjugate Vaccine (PCV)**

- Prevention of invasive pneumococcal disease (meningitis, bacteremia, …)
- Some decrease in otitis media and need for PE tubes
- Cost-effective depending on price
- ***Not a substitute for the pneumococcal polysaccharide vaccine (PPV)***

Pneumococcal Immunization

Age → / Vaccine ↓	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	24 mo
	4-6 wks	1-2 mo	3-5 mo	7-11 mo	12-18 mo	19-23 mo	24 mo-5 yrs	
Pneumococcal [7]		PCV	PCV	PCV	PCV	PCV	PPV	

Kids > 7 m/o require fewer doses

7-11 m/o 3 doses
12-23 m/o 2 doses
24-59 m/o 1 dose*

Pneumococcal Polysaccharide Vaccine (PPV)

- **Polysaccharide vaccine w/ 23 serotypes**
  - ✓ **covers strains 85-90% of bacteremic infections**
- **Substantial reduction in invasive disease**
- **Indications:**
  - ✓ **> 65 y/o**
  - ✓ **≥ 2 y/o w/ chronic pulmonary, CV dz**

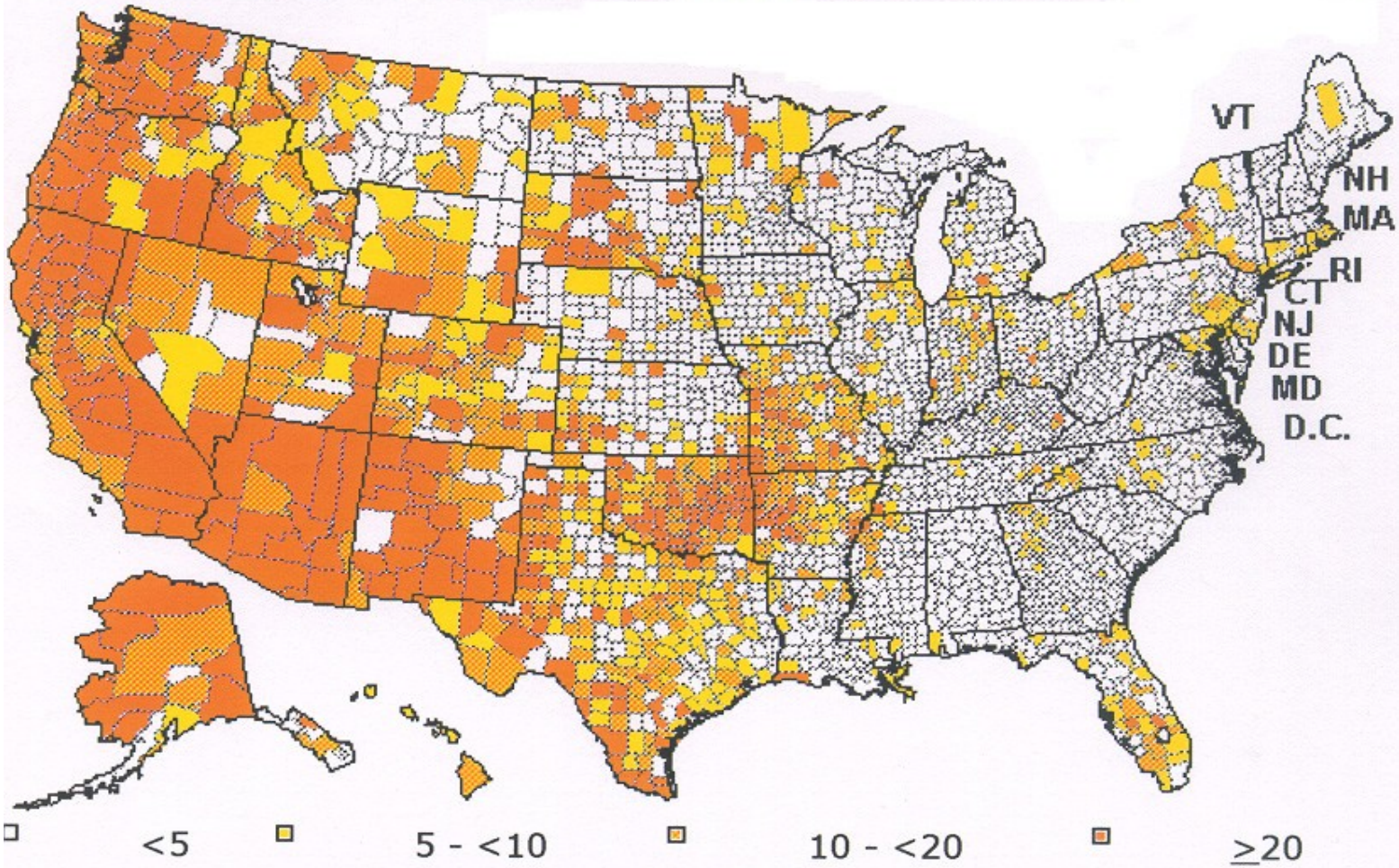
Revaccination (PPV)

- **Recommendations continue to evolve**
- **ACIP recommends revaccination if more than 5 years since initial vaccination if:**
  - ✓ **< 65 and immunocompromised / asplenic**
  - ✓ **> 65 and received initial vaccination when < 65**
  - ✓ **Increased local reactions may occur in healthy elderly patients; no > SAE's**

Hepatitis A

- inactivated virus vaccine
- indications:
  - ✓ military
  - ✓ high risk travel/work
  - ✓ high risk life styles
  - ✓ children ≥ 2y/o living in high rate areas

Average reported cases of hepatitis A per 100,000 population*, 1987-1997



*Approximately the national average during 1987-1997.
Source: National Notifiable Diseases Surveillance System.

Hepatitis A Immunization

Age → / Vaccine ↓	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	24 mo
Hepatitis A[8]	4-6 yrs	1 mo-12 yrs	13-18 yrs			Hepatitis A series		

Given as two dose series, 6 months apa

Question

4. All of the following statements regarding influenza immunization are true except:

a. it is approved to use as early as 6 months age

b. the split virion preparation is associated with fewer side effects than the whole virus prep

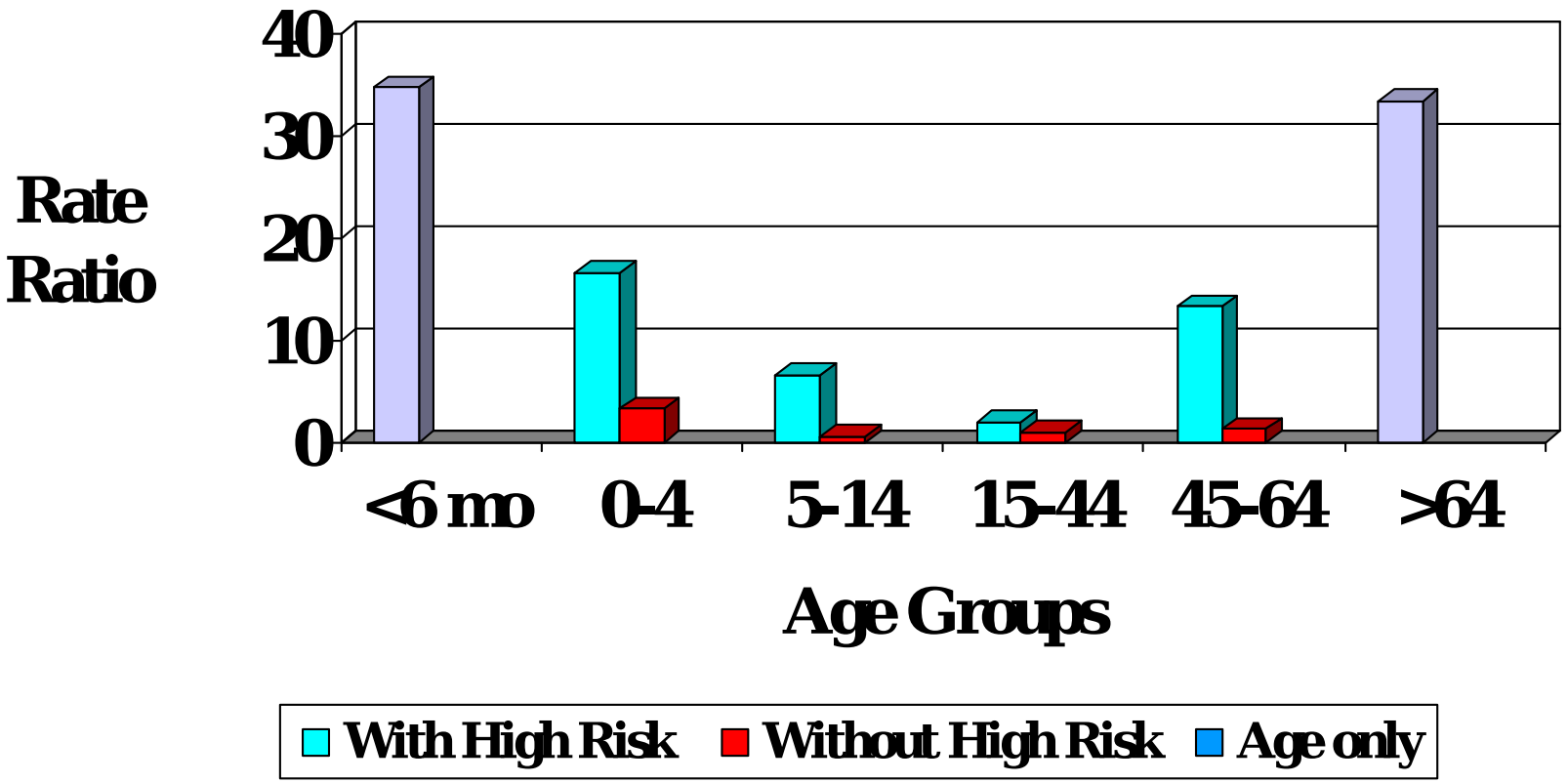
c. it is contraindicated in pregnancy

d. children less than 9 years old receiving the vaccine for the first time should receive 2 doses one month apart

e. it should be given to adults 50 and over

Why Influenza Vaccine?

Influenza Hospitalization Risk Ratios by Age/Con



Influenza Vaccine

- **Inactivated virus**
  - ✓ **3 strains: 2 type A and one type B**
- **Whole virion / split virion preparations**
  - ✓ **fewer side effects w/ split virion**
- **Grown in chicken eggs; egg allergy consideration**
- **Live attenuated intranasal influenza vaccine approved last year by FDA**

Live Attenuated Influenza Vaccine (LAIV)

FluMist™ Influenza Virus Vaccine Live, Intranasal

- Attenuated, cold adapted virus - only grows < 38ºC
- Trivalent, same as inactivated vaccine
- Administered via nasal spray
- Indicated for healthy persons age 5-49
- NOT indicated in:
  - ✓ Immunosuppressed, or their contacts
  - ✓ Pregnancy
  - ✓ Children on long-term ASA
  - ✓ Guillain Barré syndrome
  - ✓ Other high risk medical conditio
- SE's: Nasal drip or congestion, HA, S

Immunize - High Risk Patients!

- ≥ 50 y/o (newer recommendation!)
- residents of nursing homes & chronic-care facilities
- > 6 months old with:
  - ✓chronic disorders of pulmonary / CV systems
  - ✓chronic metabolic dz - diabetes & others
  - ✓kids on long term ASA therapy
  - ✓***ACIP Now Recommends ALL children 6-23 months***

Immunize - High Risk Patients!

- **pregnant women**
  - ✓**In ANY trimester gestation during influenza season (new!)**

Who Else to Immunize

- **persons who can transmit flu to high-risk patients**
  - ✓**health care/medical personnel**
  - ✓**employees of nursing/chronic care facilities**
  - ✓**employees of assisted living facilities**
  - ✓**home care givers**
  - ✓**household members (also w/ kids 0-23 mos)**
- **anyone interested in ⇓risk of infection**

Influenza Immunization in Kids

Age	Rec. Vaccine	Dose	# of Do
6-35 mo	Split Virus Only	.25	1-2*
3-8 y	Split Virus Only	0.5	1-2*
9-12y	Split Virus Only	0.5	1
> 12y	Whole or Split	0.5	1

*** two doses recommended for 1st time administration or**

Meningococcal Vaccine

- ***Neisseria meningitidis***
  - ✓**13 serotypes**
    - **strains A, C, Y, W135 cause most disease**
- **quadrivalent polysaccharide vaccine**
- **most common in children & young adults**
- **risk increased w/crowding, travel**

Meningococcal Vaccine

- indicated for high-risk pts > 2 y/o with
  - ✓asplenia, complement deficiencies
  - ✓travel to endemic areas
    - sub-Sahara Africa
    - *Hajj* to Mecca
- college students debated
  - ✓not recommended by the AAFP, ACIP
  - ✓advise students and parents

Adult Immunization Schedule *By Age Grou*

Td

Influenza

Pneumococcal

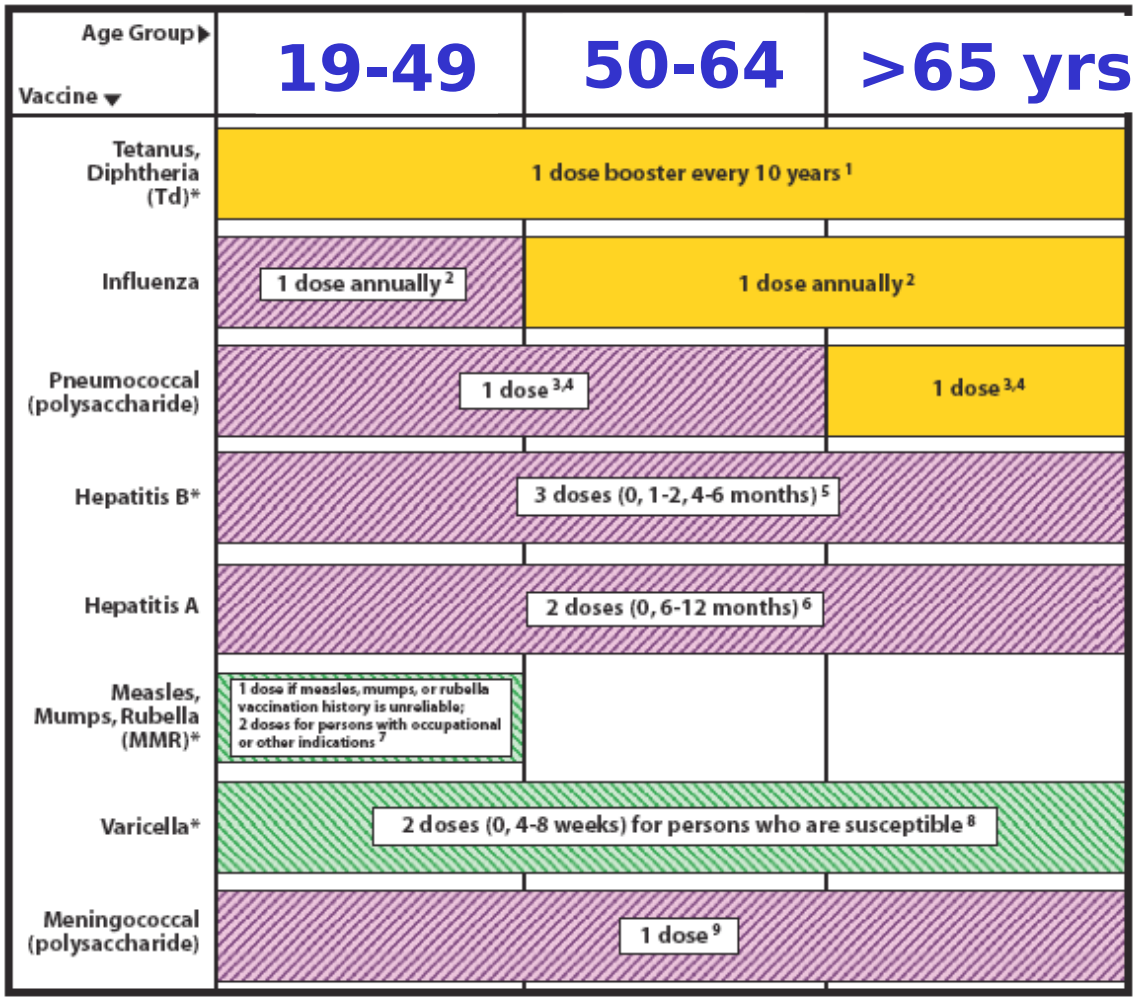
Hepatitis B

Hepatitis A

MMR

Varicella

Meningococcal



Adult Immunization Schedule *By Medical Con*

Pregnancy

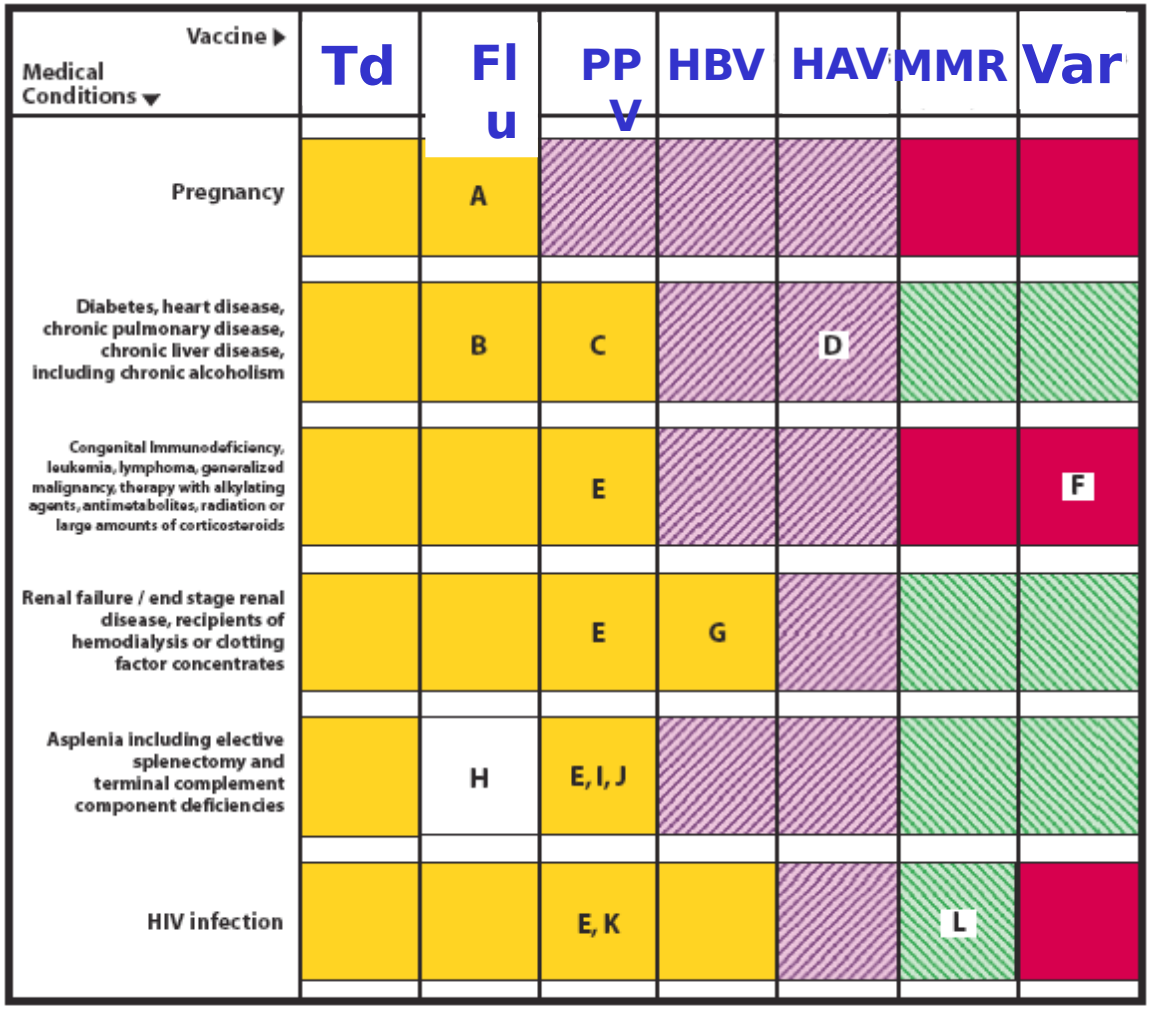
DM, CAD, COPD

Immune Comp.

Renal Failure

Asplenia

HIV



Factors Predictive of Influenza Immunization in the Elderly

- **Perception of vaccine efficacy (91-100%)**
  OR 3.4 (1,8-6,8) p<0.001
- **Advice from a doctor or nurse**
  OR 2.3 (1.6-3.4) p<0.001
- **Advice from friends**
  OR 0.4 (0.2-0.7) p<0.001
- **Side-effects of shot less risky than disease**
  OR 4.9 (2.3-10.8) p<.001
- **Perception of risk of getting influenza**
  OR 2.1 (1.1-4.0) p<0.03

Vaccine 2003; 21:2421-2427

Factors Predicting Vaccination in Adults (Influenza & Pneumococcal)

- ***The most important factor was recommendation by a health provider***
  - ✓ **75% who had influenza recommendation vaccinated vs 7% without - PR 11.2 (8.1-15.5)**
  - ✓ **76% who had pneumococcal recommendation vaccinated vs 6% without - PR 12.5 (8.4-18.6)**
  - ✓ **Even 70% of adults with negative attitudes prior to vaccination were vaccinated if a health care provider recommended it; 87% if positive**

MMWR 1988;37(43):657-661

Percent Vaccination in Adults After Provider Recommendations

(Influenza & Pneumococcal)

MMWR 1988;37(43):657-661

Question

5. Which of the interventions below is not recommended or strongly recommended to improve vaccine coverage rates?

a. Reminder –recall for patients

b. Reduction of patient out-of-pocket expenses

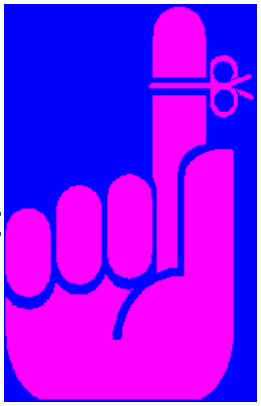
c. Assessment and feedback of providers

d. Provider education as a sole intervention

e. Standing orders for vaccination

Evidence-based Recommendations to Improve Vaccination Coverage*

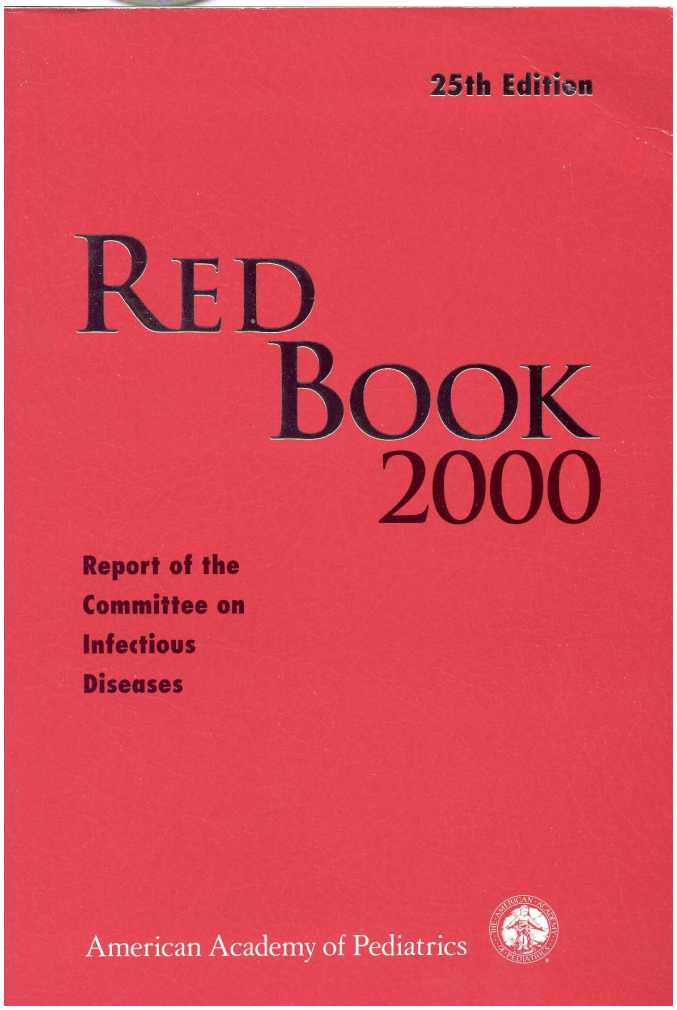
Intervention	Recommendation
Client reminder-recall systems	Strongly recommended
Provider reminder-recall systems	Strongly recommended
Provider assessment and feedbac	Strongly recommended
Reducing out-of-pocket expenses	Strongly recommended
Multicomponent interventions	Strongly recommended
Standing orders for vaccination	Strongly recommended
School, day care, and college entry requirements	Recommended
Enhancing access through WIC	Recommended
Home visits and outreach	Recommended

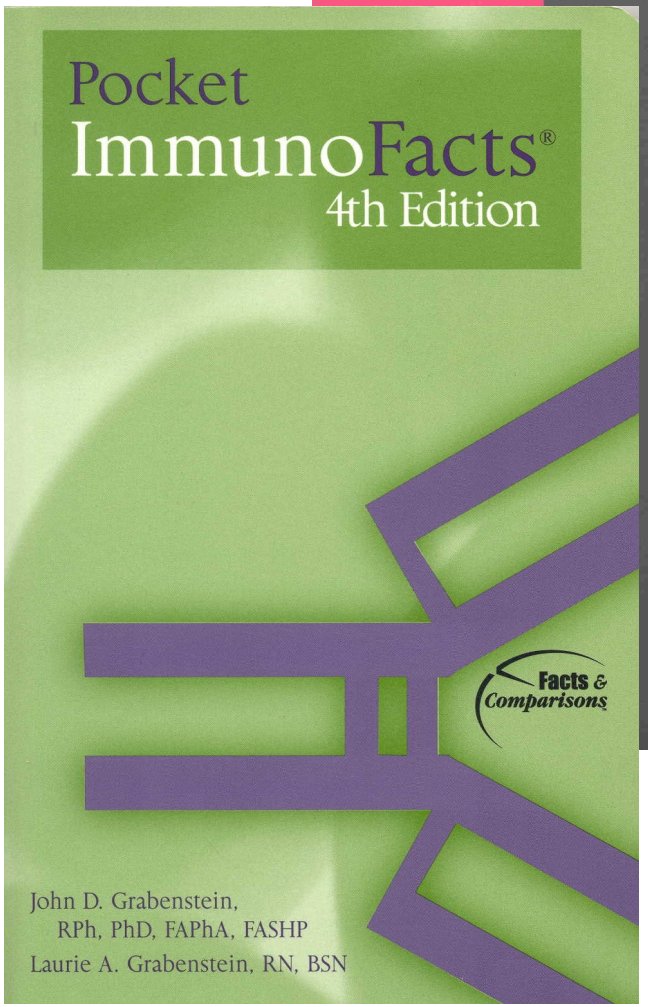


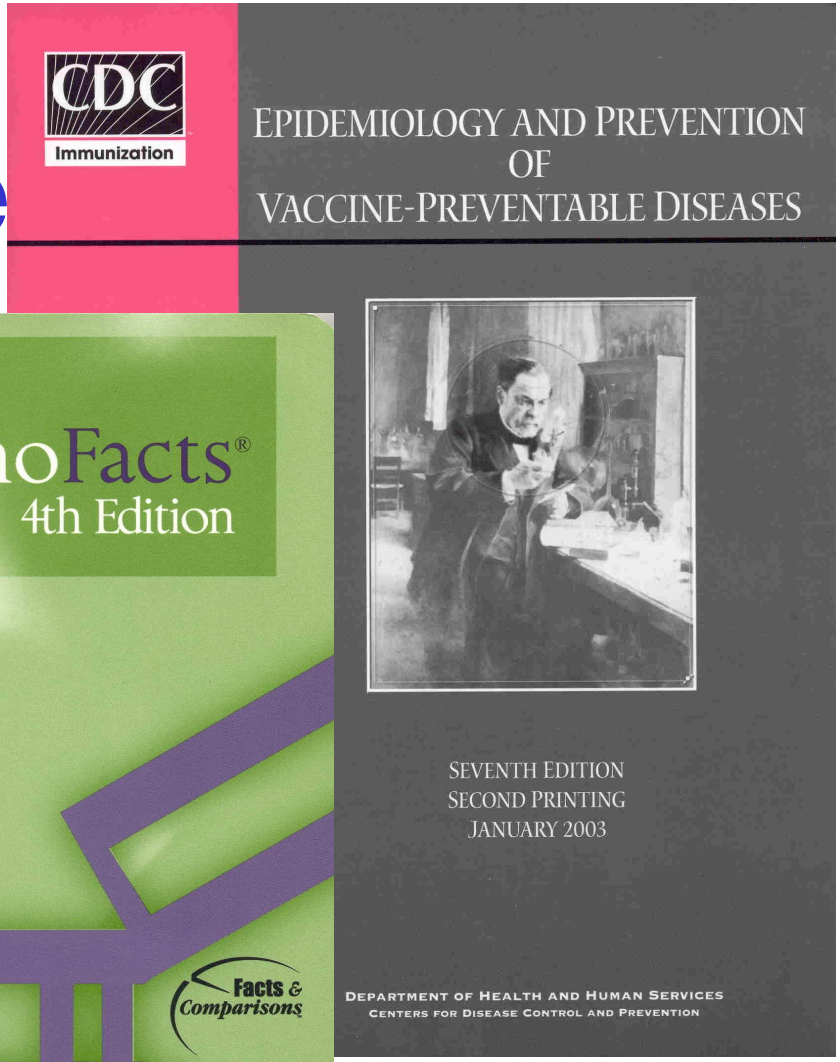
Education for providers or patients alone, NOT effective

**From Task Force on Community Preventive Services, Am J Prev Med 200;18(1S)*

Reference


25th Edition
RED BOOK 2000
Report of the Committee on Infectious Diseases
American Academy of Pediatrics


Pocket ImmunoFacts®
4th Edition
Facts & Comparisons
John D. Grabenstein, RPh, PhD, FAPhA, FASHP
Laurie A. Grabenstein, RN, BSN


CDC
Immunization
EPIDEMIOLOGY AND PREVENTION OF VACCINE-PREVENTABLE DISEASES
SEVENTH EDITION
SECOND PRINTING
JANUARY 2003
DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

References

- CDC, National Immunization Program (NIP), http://www.cdc.gov/nip.
- National Immunization Information Hotline, Hours: 8-11PM M-F, Phone: 800-232-2522.
- American Academy of Family Physicians, http://www.aafp.org/x10615.xml.
- Walter Reed National Vaccine Healthcare Center, P.O. Box 59606, Washington, DC 20012-0606, Phone: 202-782-0411, http://www.vhcinfo.org. MILVAX http://www.vaccines.army.mil/
- Immunization Action Coalition, http://www.immunize.org.

Questions?

Back-up Slides